

Vol. XIV

No. 11

DISSERTATION ABSTRACTS

(formerly MICROFILM ABSTRACTS)

*A GUIDE TO DISSERTATIONS AND
MONOGRAPHS AVAILABLE IN MICROFORM*

\$6.00 PER YEAR

\$1.50 SINGLE COPIES



DOCTORAL DISSERTATION SERIES

Cooperating Institutions

University of Arizona	University of Missouri
University of Arkansas	University of Nebraska
Boston University School of Theology	University of New Mexico
Bradley University	New York University
Brown University	Northwestern University
Bryn Mawr College	University of Notre Dame
University of Buffalo	The Ohio State University
University of Cincinnati	The University of Oklahoma
The Claremont Graduate School	University of Pennsylvania
Clark University	The Pennsylvania State University
Colorado State College of Education	University of Pittsburgh
Columbia University	Princeton University
University of Connecticut	Purdue University
Cornell University	Rensselaer Polytechnic Institute
University of Florida	Rutgers University
Florida State University	St. Louis University
George Peabody College for Teachers	University of South Carolina
University of Houston	Stanford University
University of Illinois (including Chicago Professional Colleges)	Syracuse University
Indiana University (including the Graduate Schools of Business, Education and Music)	North Texas State College
State University of Iowa	Vanderbilt University
University of Kansas	University of Virginia
Lehigh University	Virginia Polytechnic Institute
Louisiana State University	State College of Washington
University of Michigan	Washington University
Michigan State College	University of Washington
University of Minnesota	Wayne University
	Yale University
	Yeshiva University

Vol. XIV

No. 11

DISSERTATION

ABSTRACTS

(formerly MICROFILM ABSTRACTS)

*A GUIDE TO DISSERTATIONS AND
MONOGRAPHS AVAILABLE IN MICROFORM*

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1954

LITHOPRINTED IN THE UNITED STATES OF AMERICA BY
CUSHING - MALLOY, INC., ANN ARBOR, MICHIGAN, 1954

INTRODUCTION

DISSERTATION ABSTRACTS is a vital link in the process of publishing doctoral dissertations, since it makes possible the widespread distribution of information concerning the dissertations which are published in their entirety on microfilm, microcards, or microprint.

The degree to which graduate schools in America make use of this publication service, determines the value of DISSERTATION ABSTRACTS as a bibliographical tool. For its fullest use an understanding of the publication procedure is necessary. Briefly this is as follows:

- a. The author submits a carefully typed ribbon copy of the manuscript ready for publication without corrections.
- b. He also submits an abstract of 600 words or less, accurately describing the contents of the manuscript, as a guide, but not as a substitute for the complete dissertation.
- c. Both the abstract and the manuscript must be approved by the candidate's committee and the Graduate Dean as ready for publication.
- d. The manuscript is microfilmed and the negative carefully inspected and put in the vault of University Microfilms for storage, where it is kept available for purposes of duplication upon request.
- e. The abstract is printed in DISSERTATION ABSTRACTS, which is distributed, both in this country and abroad, to a large number of subscribing libraries as well as to leading abstracting services.
- f. The charge for this service is \$20.00 irrespective of the size of the manuscript.
- g. Anyone, after consulting the abstract and concluding the complete manuscript would be of value, can obtain a microfilm copy from University Microfilms at 1 1/4 cents per page, or as a paper enlargement at 10 cents per page.

There are varying degrees of partial participation in this plan available at the option of the institution. Titles only will be listed in DISSERTATION ABSTRACTS for a charge of \$2.00 each. When a university wishes to prepare its own negatives according to certain specified standards, and have that negative stored at University Microfilms where it will be available for duplication, the charge is \$12.00, which includes publication and distribution of the abstract and storage of the negative. Conceivably certain institutions will wish not only to prepare their own negatives, but to service copies as well in either microfilm, microcard or microprint. In this instance the abstract will be printed in DISSERTATION ABSTRACTS, and any requests for copies will be forwarded to the servicing institution. Interested institutions should write University Microfilms for further details of this service.

This method separates the two necessary functions of publishing: notification, or the process of informing prospective users of the existence and contents of a manuscript and distribution, or the furnishing of a copy upon demand. Each of these functions pays its own way, since if no one wishes a copy, the investment is small. However, if there is a demand, copies can be produced at current book rates.

It is anticipated that by enlarging the scope of DISSERTATION ABSTRACTS this publication will become of increasing value to librarians and scholars as a research tool. If this ideal is to be realized, close cooperation between sponsoring institutions, doctoral candidates, and University Microfilms is of the utmost importance. Now that the service is available to all Graduate schools regardless of the way its candidates publish their dissertations, it is hoped that the goal of a complete bibliography of doctoral dissertations may be realized within the next few years. Institutions are urged to write for further details.

Beginning with Volume XIV, DISSERTATION ABSTRACTS will be published monthly.

Back Issues

Libraries wishing to complete their files of DISSERTATION ABSTRACTS (MICROFILM ABSTRACTS prior to volume XII) may purchase the following issues, of which we have a small supply, at the standard price of \$1.50 each issue.

VOL.	ISSUE	VOL.	ISSUE
7	1	12	1
			2
8	2		3
			4
10	3		5
	4		6
11	1	13	1
	2		2
	3		3
	4		4
			5
			6
		14	1
			4
			7
			9

A microfilm copy can also be supplied of the first 10 volumes at a cost of \$46.60.

CONTENTS

AGRICULTURE

AGRICULTURE, GENERAL

- BECKER, Rudolph James. Capital needs of Illinois agriculture by 1975. 1861
- CARLISLE, JR., Frank Jefferson. Characteristics of soils with fragipans in a Podzol region. 1861
- FRIDLUND, Paul Russell. Studies on virus diseases infecting hardy *Prunus* grown in Minnesota nurseries. 1862
- JOHNSON, John Ronald. The effect on sales of special cooking quality potatoes separated by specific gravity—consumer acceptance in retail stores. 1863
- MacCOLLOM, George Butterick. A study pertaining to the effects and correction of DDT phytotoxicity to cucumbers. 1863
- MARTI, Fred Richard. Retirement farming in Hillsborough County, Florida. 1864
- SANDS, Fenton Bertrum. A study of the fertility status of the cocoa and coffee soils of Costa Rica. 1865

AGRICULTURE, ANIMAL CULTURE

- BROOKS, Coy Clifton. Factors which affect the utilization of rations high in cellulose. 1865
- BUSH, Leon Fredric. A study of the protein needs of fattening lambs fed shelled corn, varied amounts of corn silage and alfalfa hay, and trace amounts of cobalt and copper. 1866
- EGGERT, Robert Glenn. Studies of the leucine and histidine requirements for growth of suckling pigs. 1867
- GUYER, Paul Quentin. A study of some factors affecting sheep production. 1867
- HICKMAN, Charles Garner. Genetic variation and covariation in rate of maturity and level of production in dairy cattle. 1868
- KERCHER, Conrad John. The metabolism of cobalt, vitamin B₁₂, intrinsic factor, leucovorin, and aureomycin by cobalt-deficient lambs. 1869
- RAESIDE, James Inglis. The chemical estimation of progesterone in blood. 1869
- SIME, John Titus. A study of the metabolism of methyl-C¹⁴-methionine in the chick. 1870

- URBAN, Theodore Joseph. The effect of manganese on the histology and organ weights of cattle and the rat. 1870

AGRICULTURE, FORESTRY AND WILDLIFE

- BRUMSTED, Harlan Brown. Some causes and effects of water level fluctuation in artificial marshes in New York State. 1871
- HALL, Otis Frederick. The growth patterns of thinned and unthinned forest stands and their value in the management of the forest. 1871
- JOHNSON, Overton Rexford. The design and construction of a wood chipping unit and the determination of costs of producing wood chips from farm woodlots; with implications for forestry education in agriculture. 1872

AGRICULTURE, PLANT CULTURE

- COOK, James Arnold. An equation describing the air cooling of lettuce heads. 1873
- CORBETT, Merwin Kenneth. Hypersensitivity of *Solanum tuberosum* L. hybrids to potato virus Y (*Marmor epsilon* Holmes). 1873
- EL-TOMI, Ahmed Mohamed Labib. A study of some responses of Florida citrus trees to nitrogen nutrition and irrigation. 1874
- FLETCHALL, Oscar Hale. Studies in the establishment and management of ladino clover in Missouri. 1874
- MARTIN, Dudley Carl. The absorption and translocation of radiostrontium by the leaves, fruits and roots of certain vegetable plants. 1875
- OLSON, Robert Edward. The use of the fruit fly, *Drosophila melanogaster*, as a bioassay in detecting minute quantities of benzene hexachloride in plant tissue. 1876
- SANDSTED, Roger France. Yields of potatoes as influenced by applications of peat and manure to a sandy loam soil. 1876
- SCHAFER, Lewis Allen. The effect of nutrition on the susceptibility of tomato, *Lycopersicum esculentum* Mill., to the early blight fungus, *Alternaria solani* (Ell. and Mart.) Jones and Grout. 1877

- SCHENK, Roy Urban. The use of fungicides in the preservation of moist hay and grain. 1877

- WAHBA, Isaac Jack. The effect of varying minimum soil moisture level on growth and mineral absorption of some young horticultural crops. 1878

ANATOMY

- MARSHALL, JR., John Marvin. Cytochemical localization of certain proteins by fluorescent antibody techniques. 1879

- MONSEN, Harry. Endocrine interrelationships in the genesis of adrenal cortical tumors in inbred mice. 1879

ANTHROPOLOGY

- COHN, Bernard S. The Camars of Senapur: a study of the changing status of a depressed caste. 1880

- GUSSOW, Zachary. The contribution of associations to evolutionary changes in culture in four African societies. 1881

- KUHNS, Eileen Pease. Institutional participation of women in a California town in the structures of economic allocation, of integration, and of expression. 1881

- MURRILL, Rupert Ivan. Racial blood pressure studies: a critique of methodology, with especial reference to the effect of age, nutrition, climate, and race on blood pressure in Puerto Rico. 1882

- SCRUTON, David Lagrove. Sex differential in memory retention of aboriginal behavior patterns. 1883

- SHUKRY, Laila Sayid. The role of women in a changing Navaho society. 1883

- SKINNER, George William. A study of Chinese community leadership in Bangkok, together with an historical survey of Chinese society in Thailand. 1884

BACTERIOLOGY

- BECKER, Maurice E. Bacteriolysis by dual-enzyme systems containing lysozyme. 1885

- BRYANS, John Thomas. Studies on equine leptospirosis. 1885

- DIMOPOULLOS, George T. Electrophoretic and serum neutralization studies of sera from chickens exposed to infectious bronchitis virus. 1886

- HARTMAN, Paul Arthur. Some factors affecting growth and amylase production by Bacillus stearothermophilus ATCC 7954 on complex and synthetic media. 1887

- HEILIGMAN, Fred. Physiological factors influencing spore germination of some food spoilage bacteria. 1887

- JENSEN, Robert Gordon. Characterization of some lactobacilli found in milk. 1888

- JOHNSON, Rother Rodenious. Partial fractionation by ultracentrifugation of Newcastle disease virus into complement fixation and an infective fraction. 1889

- JONES, Agnes Lenore. The effect of Newcastle disease virus on susceptible and resistant tissues cultured from chickens and rabbits. 1889

- LOVE, Samuel Harris. Purine metabolism in bacteria. 1890

- ROCHOW, William Frantz. Multiplication of unrelated plant viruses in double infections. 1890

- SHIPKOWITZ, Nathan L. Studies on the adaptation of infectious bronchitis virus of chickens to mice. 1891

- WILSON, Elizabeth. The use of hydrogen and organic energy sources by Hydrogenomonas sp. 1891

BIOLOGY—GENETICS

- BLAKE, Roland Charles. Strawberry progeny testing and evaluation of parents for breeding. 1892

- DJAO, Er Hung. A study of acetate in growth and glycoside formation in Digitalis purpurea. 1892

- EBERSOLD, Wilbur Thomas. The isolation and characterization of some mutant strains of Chlamydomonas reinhardtii Dangeard. 1893

- FRIEND, William George. Studies upon the vitamin requirements of larvae of the onion maggot Hylemya antiqua (Meig.) under aseptic conditions. 1893

- NELSON, JR., Gideon Edmund. Relationship of the avian Family Fringillidae. 1894

- OWENS, Edward William. Dimorphism of fruit form in butternut squash, Cucurbita moschata Duch. 1894

- QUINONES, Ferdinand Antonio. Heterosis in tomatoes as affected by diverse origin of parents. 1895

- SCHWINGHAMER, Erwin. Physiologic specialization and the nature of parasitism in Colletotrichum linicolum Pethyb. & Laff. 1896

- WILLIAMS, Edwin Bruce. The inheritance of pathogenicity and certain other characters in Venturia inaequalis (Cke.) Wint.

1897

BOTANY

- DELEVORYAS, Theodore. The Medullosae — structure and relationships.

1897

- FAIRBROTHERS, David Earl. Relationships in the Capillaria group of Panicum.

1898

- FERRIS, Virginia Rogers. Histological study of suscept-pathogen relationships between Solanum demissum Lindl. derivatives and Phytophthora infestans (Mont.) deBary.

1899

- FISHER, Tharl Richard. Taxonomy of the genus Heliopsis (Compositae).

1899

- LUTES, Dallas Denver. Inheritance of resistance to systemic tobacco mosaic infection in pepper.

1900

- MILLIKAN, JR., Daniel Franklin. Studies of the ringspot virus complex in sweet cherry.

1901

- PANTIDOU, Maria Emmanuel. The foliage as a source of secondary inoculum for tomato anthracnose and the non-specificity of the causal organisms.

1901

- SCHMIDHAUSER, Thelma Ficker. Cytotaxonomic studies in the Amaryllidaceae.

1902

- TOWERS, George Hugh Neil. The keto acids of plants: their identity, analysis, and metabolic roles.

1903

- DEKKER, Eugene Earl. Urea as a source of nitrogen for the biosynthesis of amino acids.

1907

- DOISY, Richard Joseph. Studies on xanthine oxidase.

1907

- ENGLAND, Marta Cancio. A comparative study of the chemistry of the nuclei of ova, spermatozoa and liver cells in the frog (Rana pipiens).

1908

- GRAINGER, Robert Ball. Maternal nutrition and congenital anomalies in the rat.

1908

- LUTZ, Ruth Nellie. Studies on the assessment of ascorbic acid nutriture in the human and in the guinea pig.

1909

- NEEDHAM, John William. Chemical and biological investigation of unidentified growth factors in condensed fish solubles.

1909

- OTTEY, Leo Joseph. Metabolic studies on E. coli 113-3.

1910

- RÉMILLARD, Guy-Laurent. Histochemical and microchemical observations on the lipids of the interscapular brown fat of the female vesperilionid bat, Myotis lucifugus lucifugus.

1910

- RODBELL, Martin. Some aspects of lecithin metabolism in the liver.

1911

- SCHMID, Rudi. Studies in human and experimental porphyria.

1911

- TRITSCH, George Leopold. Some of the general chemical properties of the proteins in hog hair.

1912

- WOEBER, Howard H. A biochemical study of cellulose synthesis by Acetobacter xylinum.

1913

CHEMISTRY

CHEMISTRY, GENERAL

- CHULSKI, Thomas. The volumetric determination of peroxydiphosphate.

1904

- DEHM, Richard Lavern. I. The evaluation of urea adduct fractionation of waxes by x-ray and electron diffraction and other techniques. II. The structure of metal films on glass fibrils.

1904

- WATTS, Exum Dever. I. The preparation of some mercurial diuretics. II. The ultraviolet absorption spectra of certain aromatic oximes.

1905

CHEMISTRY, BIOLOGICAL

- BASFORD, Robert E. The nature of the thiol group of coenzyme A.

1906

- DAYAN, Victor Hyman. A polarographic investigation of amino acids.

1906

CHEMISTRY, INORGANIC

- BARNARD, Robert Luman. Reactions of symmetrical germanium (IV) compounds with nitrogen donor molecules.

1913

- BENTLE, Gordon George. Gamma loop studies in the iron-silicon and the iron-silicon-titanium systems.

1914

- COLTON, Ervin. Studies on the synthesis of hydrazine.

1914

- COOLEY, William Edward. The stereochemistry of complex inorganic compounds optical-geometric isomerism of the dinitro-ethylenediamine-isobutylene-diamine-cobalt (III) ion.

1915

- ELKIND, Michael J. Thermal analysis of two component systems.

1916

- PETERSON, John Ivan. Coprecipitation of thallium with silver chloride precipitated from homogeneous solution.

1917

REBERTUS, Robert Lee. Stabilization of valence through coordination: I. The stabilities of some complexes of α -amino acids with divalent metals. II. A polarographic study of the complexes of hydrazine with zinc and cadmium.	1917	LOVELACE, Alan Mathieson. The use of the peroxide-catalyzed reactions of bromofluoromethanes in the preparation of olefins and dienes containing fluorine.	1929
SMITH, William Channing. Nitrogen compounds of the phosphoric and phosphonic acids.	1918	McDANIEL, Darl Hamilton. A new approach to the steric effects of halogen substituents in aromatic systems.	1929
ZIMMERMAN, Alfred Bartley. The oxidation of magnesium in pure oxygen and in an iodine-oxygen atmosphere.	1919	MICHAELIS, Carl I. The preparation and reactions of certain quaternary ammonium and related compounds.	1930
CHEMISTRY, ORGANIC		MORRIS, Roger Earl. Part I. Reaction of substituted ethylenes with mercuric nitrate. Part II. Preparation of some substituted tetrahydroimidazoles.	1930
ANDERSON, William Sunley. I. Copolymers and terpolymers of methylacrylonitrile dimer. II. Copolymers of symmetrical aromatic hydrocarbons.	1920	MOSKOWITZ, Mark L. The structure of the products of the condensation of thiophenols with formaldehyde and secondary amines.	1931
BELLO, Jake. Some studies in the chemistry of N-bromosuccinimide.	1921	RYDER, JR., Elliott Elkington. I. An attempted synthesis of 3,4-dimethylene-thiophane. II. Copolymerization of butadiene with fumaronitrile and substituted alkyl acrylates.	1931
BREZINSKI, Julius John. Use of the internal Michael reaction in the synthesis of morphine analogues.	1921	SHIELDS, Alfred Duane. Some acid-catalyzed reactions of alkylbenzenes.	1932
BUCKLER, Sheldon Allan. The reaction of oxygen with organometallic compounds.	1922	SMUTNY, Edgar J. Chemistry of 10-phenylphenanthrol-9, particularly electrophilic and nucleophilic substitution.	1933
BUSER, Kenneth Rene. The metalation of dialkyl sulfones.	1923	STAHL, Roland Edgar. Synthesis and attempted resolution of 2-(ω -carboxypropionyl)-1,4-decamethylenebenzene.	1934
CHRISTMAN, Donald Lee. Studies on halogenated acetic acids and esters.	1924	STEWART, Ross. A study of the mechanism of the reaction of permanganate with aldehydes.	1934
CRAWFORD, JR., George H. The nature and reactions of halogen addends of the silver fluorocarbon carboxylates.	1924	CHEMISTRY, PHYSICAL	
DUNNING, Edward B. Heterogeneous bimolecular reduction II. The Emmert reaction. N-alkyl piperidines as potential analgetics.	1925	BOLMER, Perce W. The polarographic reduction of nitrobenzene and benzophenone in alcohol solutions.	1935
FERNANDEZ, Jack Eugene. Theoretical studies on the Mannich reaction.	1925	BOLT, Gerard Hendrik. Physicochemical properties of the electric double layer on planar surfaces.	1936
GOLDSTEIN, Albert. Unsaturated ten-membered carbocycles.	1926	DANFORD, Merlin Dale. An electron diffraction investigation of the molecular structures of methyl cyanide, trifluoromethyl cyanide, 1,1-dichloroethane, and cyclooctane.	1936
HARPER, Lee Richard. The structure of gliotoxin: anhydrodethiogliotoxin.	1926	FISCHER, David John. Application of Raoult's Law to ternary mixtures.	1937
HEBERLING, JR., Jack Waugh. The reaction of α -haloacetals with mercaptans: substitution reactions of 1,2-vinyl-bissulfides.	1927	FREEMAN, Robert David. The measurement of vapor pressures and molecular weights of vapors at high temperatures.	1937
HUTTON, Thomas Watkins. A study of the Wolff rearrangement.	1927	KEELING, Charles David. The irradiation of polyethylene.	1938
KRYSIAK, Henry Raymond. The effect of substituents in trimethylarylsilanes: Part I. The conjugative ability of the trimethylsilyl group. Part II. Friedel-Crafts acylations with trimethylsilylbenzoyl chlorides. Part III. Electrophilic substitution by hydrogen in the xylenes. The kinetics of acid cleavage of the trimethylsilylxylenes.	1928	LASKOWSKI, JR., Michael. Thermodynamic considerations of protein reactions.	1938

LOBUNEZ, Walter. The dipole moments and structures of organic peroxides and related substances.	1939	HEDGES, Robert Atkinson. Principles of financial analysis of underwriting expenses in property insurance.	1947
LUND, JR., John Turner. An apparatus for the measurement of the absorption spectra of transient molecules.	1939	LEE, Charles Edgar. Economic effects of sanitary regulations relating to milk markets (a study in marketing policy).	1948
MOYNIHAN, Robert Edward. Studies in molecular spectroscopy: the influence of Coriolis coupling on infrared band shapes.	1940	MANNING, Travis Warren. An analysis of the economic efficiency of Minnesota dairy cooperatives.	1948
PETERSON, Lowell Eugene. The sorption of gases having acidic and basic properties on nylon fibers.	1940	SUSSNA, Edward. Public policy towards labor-management relations in local public utilities in selected states, 1947-1952.	1949
RAMALHO, Rubens Sette. A new method for obtaining vapor-liquid equilibrium data.	1941	ECONOMICS, COMMERCE — BUSINESS	
SMULLIN, Charles Frederick. The separation of metal oxides by closed system chlorination.	1941	CHARVAT, Frank J. The development of the supermarket industry through 1950 with emphasis on concomitant changes in the food store sales pattern.	1950
STEELE, William Arthur. The interaction of non-polar gases with surfaces.	1941	DAUTEN, JR., Paul Martin. Business forecasting and its functional role.	1951
ULTEE, Casper J. Studies in molecular structure: the vibrational spectra of $\text{CF}_2=\text{CD}_2$ and $\text{CF}_2=\text{CHD}$ and the infrared and Raman spectra of CCl_3CN .	1942	HASTINGS, Delbert Curtis. A monthly index of regional business activity based on net product measurement.	1951
VAUGHAN, George. An electron diffraction investigation of the molecular structure of perfluorotrimethylamine and trifluoroethanol.	1942	JORDAN, Louis Hampton. Accounting standards.	1952
WENTINK, JR., Tunis. Vibrational spectra of triatomic linear molecules containing carbon and oxygen, sulfur, selenium, or tellurium.	1942	NELSON, Robert Alfred. Scandinavian Airlines System: a case of international cooperation.	1953
WILBURN, Richard Lee. Properties of the electrical double layer on a platinum electrode.	1943	STELZER, Irwin Mark. The cotton textile industry.	1953
ZWERDLING, Solomon. Direct production of large oriented thin sections of a single crystal by controlled growth from the vapor at low temperatures: infrared absorption anisotropy in a single crystal of benzene.	1944	ECONOMICS, FINANCE (INCLUDING PUBLIC FINANCE)	
DOMESTIC SCIENCE		BRANDT, Harry. U. S. monetary and credit policies between the end of World War II and the outbreak of the Korean War, with special emphasis on quantitative credit controls.	1954
COOK, Ruth Helen. The participation of graduates of the New York State College of Home Economics, Cornell University, 1911-49, in community and professional organizations.	1945	DAHL, Reynold Paul. An economic analysis of the agricultural production lending activities of Minnesota country banks.	1955
JACOBSON, Marion Elma Louise. Effects of three levels of nutrition and age on the quality of beef from Holstein cattle: weight, moisture, fat, nitrogen, iron, vitamin B_{12} , color, shear force, cooking data and palatability.	1946	HENNING, Dale Ansgar. Wage stabilization policies and problems, 1950-1953.	1955
ECONOMICS		PYE, Malcolm Lionel. Reporting asset transactions.	1956
ECONOMICS, GENERAL		ZIMMERMAN, Vernon Kenneth. British backgrounds of American accountancy.	1956
ALTAZAN, John Edward. Economic aspects of restriction of entry into the motor carrier industry with special reference to Interstate Commerce Commission policy.	1946	ECONOMICS, HISTORY	
		BEALL, John Wood. A study of population and capital movements involving the South.	1957
		SMITH, JR., Alfred Glaze. Economic readjustment of an old cotton state: South Carolina, 1820-1860.	1958

THOMAS, Norman Francis. Minneapolis-Moline: a history of its formation and operations.

1959

ECONOMICS, THEORY

ROUSSEAS, Stephen William. An inquiry into the logical and empirical foundations of the subjective theory of value.

1959

EDUCATION

EDUCATION, GENERAL

BROWN, Bartley Frank. A critical analysis of the function of the board of trustees in the administration of the county school systems in Florida.

1961

CHEN, Grace Siu-Ying. The concepts of democracy among adolescents.

1961

DUNCAN, James Kelman. An instrument for measuring readiness for curriculum change.

1962

JENKINS, William Atwell. A critical evaluation of standards for punctuation found in selected high school language textbooks in relation to current practices in punctuation.

1962

KJOS, Oscar Edwin. Occupational experience and success of day-trade versus general high school graduates.

1963

KRUBECK, Floyd Earl. Relation of units taken and marks earned in high school subjects to achievement in the Engineering College.

1963

NEYSARI, Salim. Comparative method of teaching Persian as the mother tongue and as a foreign language, with special reference to the work of beginners.

1964

PASCHALL, Davis Young. The leadership function of the State Department of Education in the improvement of nursery school and kindergarten opportunities in Virginia.

1965

SAUPE, Joseph Lee. Trouble shooting electronic equipment: an empirical approach to the identification of certain requirements of a maintenance occupation.

1966

SCHRAER, Harald. Survival education: a survey of trends in survival education in certain public schools and teacher training institutions and a detailed study of the elements of survival education found in the programs of the Boy Scouts and Girl Scouts of America.

1966

SMITH, Lyman John. Internal structure of an electronics achievement test examined by a principal axes analysis and a homogeneous clustering technique.

1967

THOMPSON, Yewell Reynolds. Techniques for studying program development within a school.

1968

EDUCATION, ADMINISTRATION

ATTEBERRY, Pat Herman. Nature and amount of pre-employment training needed for entry occupations in the Kansas City labor market area.

1969

BARBOUR, Julius Ervin. The selection and instruction of public school custodians in selected school systems.

1969

CARTER, Patricia Hadaway. An exploratory study of relationships existing among a public school principal's background, self concept, role concept, values, and pattern of work.

1970

COE, Burr Deline. A job analysis of the vocational high school principalship.

1971

CORLEY, Clifford Lee. The incidence of certain factors relating to dropouts from the 1948-52 class at the University of Missouri.

1972

EBAUGH, A. Raymond. An evaluation of the processes used in a curriculum program.

1972

GOMON, Neal Sidney. Financial implications of a type of school district reorganization in Nebraska.

1973

GREGORY, Louis P. An evaluation of the organization, administration, and financing of the Extended Public School Program for metropolitan areas of Florida.

1974

HANSFORD, Byron Wiseman. A study of the Public School Retirement System of Missouri.

1975

HENDERSON, Lee Gibbons. A study of certain school-community relationships with special reference to working patterns of school principals.

1975

INABNIT, Darrell James. Characteristics of teacher participation in decision-making functions of public-school administration: an empirical investigation of teacher participation in policy-making and related factors in four Illinois public-school systems.

1976

McBRIDE, William Byrl. An application of the scientific attitude to some of the requirements, practices and objectives of the doctoral program.

1977

McPHERRAN, Archie LeRoy. The nature and role of the intermediate district in American education.

1977

O'CONNOR, Edward Burton. A study of the extent of responsibility delegated to Nebraska public school superintendents by boards of education.

1978

PEPPER, James Nelson. Factors involved in the recruitment and retention of teachers in Michigan.	1979
PRENTIS, Roy Clifford. The relationship between school district organization and public schoolhousing needs in Minnesota.	1980
RECKEWEY, Rex Klein. The role of the university and recent trends in the conduct of school surveys.	1980
RICHARDSON, JR., Lester Scott. The school superintendent's job: a study of his function and status in the public schools located within a one-hundred mile radius of Houston, Texas.	1981
SMITH, Stanley Vernon. Quality of education related to certain social and administrative characteristics of well-financed rural school districts: a study of the central schools of New York State.	1982
STONE, James Edgar. Measurement of selected factors affecting change in school district structure.	1983
VAN AKEN, Elbert William. An analysis of the methods of operation of principals to determine working patterns.	1983
VARNEY, James Keith. The responsibility of the assistant superintendent or other executive for instructional supervision and curriculum development.	1984
WERESH, Andrew Anthony. Identification and evaluation of post-high school educational activities of the class of 1950 in selected Nebraska communities.	1985
WOLFE, Charles Jordan. A study of the cooperative work experience program in the Detroit public high schools.	1986

EDUCATION, ADULT

POFFENBERGER, Thomas Millard. A technique for evaluating family life and mental health films.	1986
TREGILGUS, Earl Perrin. A survey and evaluation of the employee training programs in the laundry and dry cleaning industries in Indiana.	1987

EDUCATION, HISTORY

CHAPMAN, John Griffin. The re-education of the Japanese people.	1988
SHRIDEVI, Sripati. The development of women's higher education in India.	1989

EDUCATION, PHYSICAL

JUEL, JR., Martin Oliver. The effects of present methods of teaching on attitudes of men students at Southwest Texas State Teachers College toward recreational physical activity.	1990
--	------

EDUCATION, PSYCHOLOGY

ASHER, JR., Eston Jackson. An investigation of the relationship between attitudes of high school students toward ethical practices and several environmental variables.	1991
CHAMBERS, Frank May. The relationship of empathy to scholastic success with implications for student personnel workers.	1991
FAUSET, Charles Edwin. Changes in responses to selected typical personality questionnaire items administered under three sets of directions.	1991
FORDYCE, Joseph Warder. An analysis of evaluative studies in selected areas of guidance.	1992
GLAZER, Stanford Howard. Development of Michigan college counseling programs — 1940-1950.	1993
HOLDEN, Ruby Mae. Relationships between perceived leadership, perceptions of the ideal, and group productivity in small classroom groups.	1994
HOYT, Kenneth Boyd. A study of the effects of teacher knowledge of pupil characteristics on pupil achievement and attitudes towards classwork.	1994
LEBSACK, Jacob Robert. Specific reading ability as associated with subject matter achievement.	1995
MOON, JR., Alfred Cornelius. An investigation of the scope of mood responses of intermediate grade pupils.	1996
PHELAN, Robert F. Some effects of task induced tension in school children.	1997
POE, Wesley A. Differential value patterns of college students.	1997
TERRILL, Sarah Gentry. A study of visiting teacher cases receiving lengthy service.	1998
WALKER, Ralph Harpham. A technique for assessing teacher human relations.	1999

EDUCATION, TEACHER TRAINING

DOWNING, Mary Riggan. A study of certain factors involved in the effective utilization of the services of educational consultants.	1999
HOLMBLADE, Amy Jean. A comparative study of the clothing area of the secondary homemaking curriculum in a selected community and related beliefs and practices of families in that community.	2000
LaBUE, Anthony Charles. An analysis of some factors associated with persistence of interest in teaching as a vocational choice.	2001

LOVELL, John Thomas. A study of the relationship between the style of teacher participation in the total classroom group and the internal structure of sub-groups in the classroom.	2002	SOUTHARD, Charles Walter. The effect of student-selection of adviser on rapport.	2012
MATHEWS, Walter B. Techniques for studying certain professional activities of teachers.	2002	THOMPSON, Orville Eugene and TOM, Frederick Kwai Tuck. An experimental study to determine the comparative effectiveness of two patterns of teaching vocational agriculture.	2012
METAWEH, Ibrahim Esmat. Improvement of rural teacher education in Egypt.	2003	THROSSELL, Wilbur Irving. Organizational approaches to the development of communication courses in college programs of general education.	2013
QUICK, Otho James. Teaching and non-teaching baccalaureate degree graduates with industrial arts majors: a comparative study of former students of Eastern Illinois State College aimed at improved counseling and related aspects of preparation: thirteen items on record, types of teaching and non-teaching positions, present status, causes of separation, and professional attitudes.	2003	WOLLARD, Garland Sayers. A survey of public relations practices in local school building programs.	2013
ROTH, Earl Allen. The recruitment and admission of students to teacher education.	2004	ZOLLITSCH, Herbert George. Maintenance training methodology for automation: the development of methods and techniques which might be utilized to assist industry in training maintenance mechanics to service complicated, custom-built, semi-automatic or fully automatic machines.	2014
EDUCATION, THEORY AND PRACTICE		ENGINEERING	
CHASE, JR., John Bryant. A project in the cooperative production of instructional guides for teachers of science.	2005	ENGINEERING, GENERAL	
HILL, Thomas Jordan. Experimental study of selected instructional material in social class at the secondary level.	2006	WIEHE, Theodore Edgar. A follow-up of engineering drop-outs, University of Missouri, 1947-1952.	2016
JOHNSON, Lloyd Kenneth. Achievement in physics at the secondary school and junior college levels with implications for grade placement of concepts.	2006	ENGINEERING, AERONAUTICAL	
JUNG, Joseph Weiland. A study of the factors associated with music participation by secondary school pupils in the suburban areas of Minneapolis and St. Paul.	2007	BOLLARD, Richard John Holden. Effect of secondary stresses on the dynamic characteristics of aircraft structures.	2016
KHALID, Abdulrahman M. Science education in the Iraqi society.	2008	ENGINEERING, CHEMICAL	
KOWITZ, Gerald Thomas. An exploration into the relationship of physical growth pattern and classroom behavior in elementary school children.	2009	GEIGER, JR., Marlin George. The production of vinyl chloride in a fluidized catalyst bed.	2017
MANOLAKES, George. A study of certain selected elementary schools for the purpose of developing criteria for the appraisal of the elementary school.	2010	HOLMGREN, John Daniel. Kinetics of processing asphaltic residues.	2017
MARTIN, Glen Henry. Duties of the director of elementary education in selected school systems in Missouri.	2010	KULKARNI, Ghananeel R. Mechanism of wood pulping by the Kraft Process.	2017
PAOLUCCI, Daniel John. The development of a multipurpose job analysis method for a selected Navy rating.	2011	RATCLIFF, Gerald Alfred. Kinetics of sulfonation reactions.	2018
		SEDALIA, Bhikhubhai Mahadeo. A study of the bonding by air-setting refractory mortar at elevated temperatures.	2018
		SIMPSON, Theodore B. Applications of evaporated metal films.	2019

SOVRAN, Gino. The rate and mechanism of drying for wheat middling particles.	2020	RANDOLPH, Burton Woodruff. The stimulation of infra-red sensitive phosphors as a function of temperature and wavelength.	2030
THREADGILL, Walter Dennis. An oxide process for metallic calcium.	2020	THRASHER, Lawrence William. The effects of edge thickness and edge sharpness on small orifices.	2030
YEE, Tin Boo. Part one: Relation of composition to viscosity and surface tension of the enamel glasses. Part two: Relation of viscosity, nuclei formation, and crystal growth in titania-opacified enamel.	2021	WHITBY, Kenneth Thomas. The mechanics of fine sieving.	2031
		WU, Tang. Melting of ice from transmission lines.	2031
ENGINEERING, CIVIL		ENGINEERING, METALLURGY	
CHEN, Tien You. Numerical determination of influence coefficients for moments in skew I-beam bridges.	2022	SHIH, Sheng-Tai. Hydrogen overvoltage on titanium.	2032
HERRIN, Moreland. Effects of aggregate shape on the stability of bituminous mixes.	2023	SWALIN, Richard A. Solid state diffusion of several elements in nickel at elevated temperatures.	2032
WU, George Shaochih. A numerical procedure for the analysis of hipped-plate structures.	2023	WANG, Yen-Ngen. The rate of dissolution of aluminum in hydrofluoric acid.	2033
ENGINEERING, ELECTRICAL		ENGINEERING, SANITARY AND MUNICIPAL	
BAILEY, Albert David. An investigation of the direction of arrival of radio waves.	2024	BRAZIS, Adolph Richard. Microbiological fermentation of dairy wastes.	2034
BALABANIAN, Norman. Approximation methods in network synthesis.	2024		
FLOOD, JR., Walter Aloysius. The fading of ionospheric signals.	2025	FOOD TECHNOLOGY	
LUDWIG, John Truman. A study in the design of magnetic circuits employing soft magnetic materials and superposed a-c and d-c magnetization.	2026	LOUTFI, Salah-Eldin Mahmoud. Effect of weight gain and weight loss on certain body and blood constituents of rats.	2034
SILVERMAN, Bernard. Periodic solutions in higher order nonlinear systems.	2026		
WILLIAMS, JR., Walter Jackson. The response of linear networks to a forcing function of the form $\cos t^2$.	2027	GEOGRAPHY	
ENGINEERING, MECHANICAL		GEOLOGY	
GEBHART, Benjamin. Generalized thermodynamic properties of gases at high densities.	2027	DEAN, John Henry. A land use study in the Uganda Protectorate.	2035
GETZ, James Edward. The time variation of the spatial distribution of cool flame radiation in an engine cylinder.	2028	ERVIN, Roger Edward. Land use in Southern Middle Chile.	2036
HOE, Robert Julius. Heat transfer coefficients and pressure drop in the flow of liquid metal across a bank of tubes.	2029	KELLEY, Arthell. Some aspects of the geography of the Yazoo Basin, Mississippi.	2036
McQUISTAN, Richmond Beckett. The infrared diffuse reflectance characteristics of various surfaces and materials.	2029		
		BROWN, Eugene. The geochemistry of the ground waters of Northeastern Florida and Southeastern Georgia.	2037

- SCHULTZ, Leonard Gene. The petrology of underclays. 2037

- STEWART, David Perry. The surface geology of Pleistocene history of the Watertown and Sackets Harbor quadrangles, New York. 2038

HEALTH SCIENCES

HEALTH SCIENCES, GENERAL

- JORGENS, Joseph. The relationship between certain physiological variables and the electrokymographic recording of ventricular action. 2039

HEALTH SCIENCES, DENTISTRY

- ZWEMER, Jack D. Lactic acid formation in lactobacilli exposed to fluoridized enamel. 2039

HEALTH SCIENCES, NURSING

- HALEY, Wilhelmine L. Crucial requirements in nursing for the sciences of anatomy and physiology. 2040

HEALTH SCIENCES, PATHOLOGY

- KENNEDY, Peter Carleton. Pathology of Ascaris lumbricoides and Trichinella spiralis infection in cattle. 2041

HEALTH SCIENCES, PHARMACY

- HERTZ, Joel John. A stability and solubility study of riboflavin and some derivatives. 2041
- McCOWAN, James Robert. Evaluation of collyria by the rabbit eye method. 2042
- PLAXCO, JR., James McElwee. The effect of various substances on the antibacterial activity of bacitracin in ointments. 2042
- SCHIMMEL, Jerome. The effect of various preservatives on microorganisms isolated from deteriorated syrups. 2042

HISTORY

HISTORY, GENERAL

- CHALFANT, Edward Allan. Henry Adams and history. 2043

HISTORY, MEDIEVAL

- YOUNG, Charles Robert. The place of the borough in English administration during the twelfth and thirteenth centuries. 2044

HISTORY, MODERN

- ANGUIZOLA, G. A. Fifty years of Isthmian-American relations: an analysis of the causes jeopardizing Isthmian-American friendship. 2044
- BAUGHN, Milton L. Social views reflected in official publications of the Cumberland Presbyterian Church, 1875-1900. 2045
- CHRISTIE, Robert A. Empire in wood: a history of the United Brotherhood of Carpenters and Joiners of America. 2046
- FAGGI, John Alexander Butler. The beginnings of the Italian Socialist Party (1890-1900). 2046
- GOLDNER, Werner Ernst. The role of Abdullah ibn Husain, king of Jordan, in Arab politics, 1914-1951: a critical analysis of his political activities. 2047
- HILDRETH, Charles Halsey. A history of Gainesville, Florida. 2048
- HOWE, Jack Homer. Britain and the U.S.S.R., March-September 1939: emergence and dissolution of Entente hopes. 2048
- KONOLD, Donald Enloe. A history of American medical ethics, 1847-1912. 2049
- LOBDELL, JR., George Henry. A biography of Frank Knox. 2049
- MARCUS, John Theodor. French Socialism: its response to the growing threat of fascism and war, 1933-1936. 2050
- NAU, John Frederick. The German people of New Orleans, 1850-1900. 2051
- STABLER, John Burgess. A history of the Constitutional Union Party: a tragic failure. 2052
- WALKER, Franklin Arthur. The Whig party and domestic politics, 1830-1841. 2052

HOME ECONOMICS

- FINCH, Helen M. Young children's concepts of parental roles. 2053
- WALTERS, James Coates. Attitudes concerning the guidance of children: a study of the differential effects of an introductory course in child development on the attitudes of college women. 2054

JOURNALISM

- SHEN, James Cheng-yee. Liang Chi-chao and his times. 2055

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

- BAIR, George Eldridge. The plays of the Romantic poets: their place in dramatic history. 2056
- EVANS, Robert Owen. The theory and practice of poetic elision from Chaucer to Milton with special emphasis on Milton. 2056
- HARDER, Kelsie Brown. Style and meaning in the original works of Sir Thomas Urquhart. 2057
- HOY, Cyrus Henry. An examination into the shares of Fletcher and his collaborators in the Beaumont and Fletcher canon: an essay in the use of linguistic criteria as a source of authorial evidence. 2057
- KAWAR, Irfan Arif. Early Islam and poetry. 2058
- KELLERMANN, Frederick Dale. Montaigne's Socrates. 2059
- SANDERS, Helen Morse. Jane Austen's novels: a study in narrative method. 2059
- SYLVESTER, Howard Eugene. The American Museum, a study of prevailing ideas in late eighteenth-century America. 2060

LANGUAGE AND LITERATURE, MODERN

- ANEY, Edith Trelease. British poetry of social protest in the 1930's: the problem of belief in poetry of W. H. Auden, C. Day Lewis, "Hugh MacDiarmid," Louis MacNeice, and Stephen Spender. 2061
- BALDANZA, JR., Frank. The novels of Virginia Woolf. 2061
- BOCKES, Douglas Theodore. The late method of Henry James. 2062
- BOWEN, Frances Jean. The New Orleans Double Dealer: 1921-May 1926, a critical history. 2063
- BOWMAN, George William. Hawthorne and religion. 2063
- CHAPIN, Chester Fisher. Personification in eighteenth-century poetry. 2064
- COLBRUNN, Ethel B. The simile as a stylistic device in Elizabethan narrative poetry: an analytical and comparative study. 2064
- DODSON, Daniel Boone. Thomas Middleton's City Comedies. 2065
- EDGERTON, William Benbow. Nikolai Leskov: the intellectual development of a literary nonconformist. 2066
- GINDIN, James Jack. Renaissance and modern theories of irony: their application to Donne's Songs and Sonnets. 2066

- GRAVES, Allen Wallace. Difficult contemporary short stories: William Faulkner, Katherine Anne Porter, Dylan Thomas, Eudora Welty and Virginia Woolf. 2067
- GROBE, Edwin Paul. Sébastien Bremond: his life and his works. 2068
- HAGEMANN, Edward Robert. J. W. De Forest and the American scene: an analysis of his life and novels. 2068
- HOWARD, Donald Roy. The Contempt of the World: a study in the ideology of Latin Christendom with emphasis on fourteenth century English literature. 2069
- McFEETERS, Mary Frances. The use of Greek mythology in the French theater from 1918 to 1948. 2070
- MILLER, John Carl. Poe's English biographer: John Henry Ingram, a biographical account and a study of his contributions to Poe scholarship. 2070
- MORGAN, Ira Lee. Contemporary criticism of the works of Samuel Johnson. 2071
- PARSONS, Olive Wrenchel. The ideas of Benjamin Disraeli, Lord Beaconsfield. 2072
- RABASSA, Gregory. The Negro in Brazilian fiction since 1888. 2072
- SCHNEIDER, Robert Lee. George Eliot: her search for order. 2073
- STEPHENS, JR., Alan Archer. The shorter narrative poems of Edwin Arlington Robinson. 2073
- STEWART, Paul Robert. The Prairie Schooner: a little magazine's first twenty-five years. 2074

MATHEMATICS

- BAGLEY, Robert Waller. The topolattice and permutation group of an infinite set. 2075
- BRADT, Russell Newton. On the design and comparison of certain dichotomous experiments. 2075
- BRUMFIEL, Charles Francis. Noetherian minimal bases and equations with prescribed groups. 2076
- CAMPBELL, Sullivan Graham. On a class of non-linear partial differential equations. 2076
- CRONHEIM, Arno. Motion groups of planes. 2076
- HORTON, Thomas Roscoe. On the equivalence of quadratic forms. 2077
- JENKINS, Ted R. On fields of quotients of certain convolution algebras. 2078
- NIEMANN, Ralph Henry. A study of Stieltjes integral transforms of a certain class of functions. 2078
- NOLL, Walter. On the continuity of the solid and the fluid states. 2079

RINEY, Thomas David. On the coefficients occurring in the asymptotic expansion of the generalized hypergeometric function.	2080
RITCHIE, Bill VanTrump. On Galois theory for certain classes of nilpotent algebras.	2080
RUSSELL, Jack Unger. Decompositions of analytic functions with respect to the singular set.	2081
STANDISH, Charles Junior. Notes on a class of ergodic transformations.	2081
SWIFT, JR., George Herbert. On irregular Borel measures.	2082
WILLIAMS, Robert Fones. Reduction of open mappings.	2082
YEN, Ti. Trace on finite AW*-algebras.	2083
YOUNG, John William. Non-classical orthogonal polynomials.	2084

MINERALOGY

SCHNEER, Cecil Jack. Polymorphism in one dimension.	2084
---	------

MUSIC

GOOSSEN, Jacob Frederic. Symphony No. I.	2085
GOULD, Cassius Wallace. An analysis of the folk-music in the Oaxaca and Chiapas areas of Mexico.	2085
HALL, Jody (Joseph) C. A radiographic, spectrographic, and photographic study of the non-labial physical changes which occur in the transition from middle to low and middle to high registers during trumpet performance.	2086
LAMM, Robert Carson. The evolution of the secondary dominant concept.	2087
LIST, George Harold. An analysis of the relationship of non-stepwise melodic movement to tonality in selected works of W. A. Mozart.	2087
MUELLER, Robert Earl. The concept of tonality in impressionist music: based on the works of Debussy and Ravel.	2088
TRUMBLE, Ernest Lorenz. Early Renaissance harmony.	2089
WOOLDRIDGE, Warren Buchanan. The nasal resonance factor in the sustained vowel tone in the singing voice.	2089

PHARMACOLOGY

BARNES, Byron A. Pharmacology and toxicology of some thiuram disulfides and related compounds.	2090
KILLAM, Keith Fenton. Enzymatic basis of the action of convulsant hydrazides.	2091

NORRED, Sarah Ruth. A pharmacological investigation of avocado (<i>Persea americana</i> Mill.) oil.	2091
PLATCOW, Edward Louis. A study of the adaptability of isopropyl myristate for use as a vehicle for parenteral injections.	2092

PHILOSOPHY

ALLEN, Harold Joseph. Teleology and the activity of natural systems.	2092
COFFIN, Francis Howells. Santayana: a liberal and sceptical materialist.	2093
EDMISTEN, Leonard Martin. Coleridge's commentary on Swedenborg.	2093
ENGEL, Eva Johanna. Carl Philipp Moritz: a study of his ethical and aesthetic concepts.	2094

PHYSICS

PHYSICS, GENERAL

ASCHNER, Joseph Felix. Self-diffusion in sodium and potassium chloride.	2095
BARHYDT, Hamilton. A study of the internal friction of zinc and aluminum single crystals in the 1 to 5 kc. frequency range.	2096
BROWN, Edmond. A comparative study of methods calculation of energy bands in crystals; extensions of variation and iteration techniques.	2096
BUTTREY, JR., John William. Small angle x-ray scattering by the low carbon paraffins.	2097
CHOLET, Philip Henri. Investigations of certain frequency dependent electrical properties of biological materials.	2097
KERR, Robert Justice. An application of the scintillation spectrometer with NaI and anthracene phosphors.	2098
McMASTER, William Herbert. Angular distribution of photoelectrons produced by 0.4 to 0.8 Mev. polarized photons.	2099
ROWELL, Neal Pope. An electron diffraction study of alloys produced by the simultaneous vacuum evaporation of aluminum and copper.	2099
THOMAS, Garland Leon. Frequency dependence of acoustic cavitation.	2099

PHYSICS, ELECTRONICS & ELECTRICITY

WALDNER, Michael. A study of the luminescence and conductivity decay of zinc sulfide and silver chloride.	2100
---	------

PHYSICS, NUCLEAR

BARANGER, Gertrude Elizabeth Urey. The scattering of high energy electrons by heavy nuclei.	2100
---	------

BROWN, Hugh Needham. The disintegration of Ho^{164} .	2101
COOPER, JR., Howard Gordon. Irradiation effects in copper, silver, and gold near 10°K .	2102
JONES, Dale Robert. Production of neutrons from mesons stopped in various absorbers.	2102
MULLER, Burton Harlow. Nuclear spin-lattice relaxation in liquid and supercooled menthol.	2102
O'NEILL, Gerard Kitchen. Time of flight measurements on the inelastic scattering of 14.8 Mev neutrons.	2102
RHODY, Richard Blaine. A cloud chamber study of proton recoils from paraffin radiators bombarded by Po-Be neutrons.	2103
SOSIN, Abraham. The electrical resistivity of cold-worked aluminum single crystals.	2104
STRATTON, Thomas Fairlamb. The experimental determination of the absolute differential cross sections for the $\text{O}^{18}(\text{d},\text{p})\text{O}^{17}$, $\text{O}^{16}(\text{d},\text{p})\text{O}^{17*}$ and $\text{O}^{18}(\text{d},\text{p})\text{O}^{19*}$ reactions as a function of the incident deuteron energy and the angle of the emitted protons.	2104
TAYLOR, Theodore Brewster. Nuclear scattering of high energy neutrons and the optical model of the nucleus.	2105
VOSS, James Richard. Photoproduction of low energy charged Π mesons.	2106
WOLFE, Bertram. The elastic photoproduction of Π^0 mesons from deuterium.	2106

PHYSIOLOGY

BENNETT, Theda Elizabeth. A study of the effects of 17-vinyltestosterone in the rat with particular reference to adrenal function.	2107
BERNSTEIN, Lionel Mandel. Body composition as related to heat regulation in women.	2107
GLITZER, Monroe S. The effect of growth hormone on the renal function and electrolyte excretion in intact and hypophysectomized female rats.	2108
HENDLEY, Edith Di Pasquale. Circulatory factors influencing edema formation during hypoxemic perfusion of isolated rat hindlimbs.	2109
INGALLS, Ruth Louise. Iron from gastrointestinal sources excreted in the feces of human subjects.	2109
MERRICK, JR., Arthur West. Studies on total and fractional cardiac glycogen.	2110
RUSSELL, Robert Lee. Antagonism of emulsified fat to barbiturate depression.	2110
SMITH, JR., Charles Eugene. Variations of excitability in the central nervous system of the crayfish.	2111

STEARNS, Richard Norman. The biologically effective electric current distribution in <i>Rana pipiens</i> eggs resulting from applied circularly polarized electric currents.	2111
--	------

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

FLAHERTY, Donald William. The role of the United States Supreme Court in the settlement of inter-sovereign disputes.	2112
STEAMER, Robert Julius. The constitutional doctrines of Mr. Justice Robert H. Jackson.	2113

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

CEFKIN, John Leo. A study of the United States National Commission for Unesco.	2113
CHANG, Yu Nan. American security problems in the Far East, 1950-1952.	2114
SCHILLING, JR., Frederick Karl. Germany and her future: British opinion and policy, 1939-1947.	2115
WHITAKER, JR., Urban George. Americans and Chinese political problems, 1912-1923.	2116

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

ROBINSON, Nelson Martin. Regulatory systems and hospital standards.	2116
---	------

PSYCHOLOGY

PSYCHOLOGY, GENERAL

CHALUPSKY, Albert Bernard. Comparative factor analyses of two clerical check lists.	2118
FINN, Robert Howard. A factor analysis of selected job characteristics.	2118
FRICKE, Benno G. The development of an empirically validated personality test employing configural analysis for the prediction of academic achievement.	2118
GIROUX, Charles Rodrique. Supervisors' incentives and job satisfaction.	2119
JONES, Donald Richard. Measuring supervisors' awareness of employee attitudes: a comparison of methods.	2120
McCOLLUM, Ernest Leland. A study of the vocational interest profiles of USAF Personnel Officers with and without formal personnel training.	2120

REEVES, Margaret Pegram. An application of the semantic differential to Thematic Apperception Test material.	2121	ENGEN, Trygg. An experimental test of a method for developing ratio scales.	2133
SCHEIPS, Charles Dare. A pattern analysis of job requirement factors for a sample of jobs.	2122	MAAG, Clinton Hiland. An evaluation of conceptual thought under conditions of oxygen deprivation.	2134
SPECTOR, Paul. Cutaneous communication systems utilizing mechanical vibration.	2122	MACKINTOSH, Irene. An experimental investigation of the resistance to extinction of instrumental responses acquired under irregular conditions of learning.	2134
PSYCHOLOGY, CLINICAL		McNELLY, George Winfield. The development and laboratory-validation of a subjective fatigue scale.	2135
COBURN, Herbert H. An experimental comparison of relationship-centered and problem-centered counseling.	2123	MILLER, Irwin. Auditory perception in relation to amount of information and speech-to-noise ratio.	2136
FENN, Augustus Hall. An experimental investigation of the meanings of understanding in the counseling relationship.	2123	OVERLADE, Dan C. Humor perception as abstraction ability.	2136
GREENBAUM, Richard S. The influence of certain maternal attitudes on the behavior of rejected children.	2124	PAISIOS, John Peter. Social distance and housing: an investigation of the attitudes of an industrial population.	2137
HELMSTADTER, Gerald Carl. The relative effectiveness of varied pattern analysis techniques as applied to non-cognitive data.	2124	PETERSON, Lloyd Richard. Variable delayed reinforcement.	2137
HELPER, Malcolm Morris. Learning theory and the problem of the self.	2125	ROBINSON, Burton W. A study of hostility as reflected by the differential learning and retention of schizophrenic patients.	2138
HOYT, Donald Paul. Differential outcomes of counseling with college men.	2126	SAUCER, Rayford T. The effect of rate and energy upon the perception of apparent motion.	2138
KING, Gerald Franklin. A theoretical and experimental consideration of the Rorschach movement response: its relation to the neuropsychiatric patient's orientation to his problem.	2127	SOLLEY, JR., Charles Marion. Drive, barrier conditions, and personality variables affecting problem-solving behavior.	2139
KLEIN, Sandor. Conditioning and extinction of operant verbal behavior in neuropsychiatric hospital patients.	2127	WILLARD, JR., Norman. Level of performance in the rat as a function of training and of subsequent partial reinforcement.	2139
MARSHALL, Max Lloyd. A comparison of schizophrenics, children, and normal adults on their use of color.	2128	RELIGION	
MARTIN, Anthony William. A correlation of affective states with the use of color on the Mosaic Test.	2129	GILKEY, Langdon Brown. Maker Of Heaven And Earth: a thesis on the relation between metaphysics and christian theology with special reference to the problem of creation as that problem appears in the philosophies of F. H. Bradley and A. N. Whitehead and in the historic leaders of Christian thought.	2141
PEARSON, John Sumner. Psychometric correlates of emotional immaturity.	2129	POEHLER, Willy August. An appraisal of two types of pre-ministerial training programs of the Lutheran Church-Missouri Synod.	2141
RASKIN, Allen. A learning theory paradigm for perceptual vigilance and perceptual defense phenomena.	2130	SOCIAL PSYCHOLOGY	
WILLIAMS, JR., Milton Hugh. The influence of variations in instructions on Rorschach reaction time.	2131	CLINE, Marvin Gerard. Some perceived properties of social interaction.	2142
PSYCHOLOGY, EXPERIMENTAL		JAMBOR, Helen M. Discrepancies in role expectations for the supervisory position—a concern of social work administration.	2143
BILGER, Robert Clark. A comparison of monaural and binaural listening in three levels of ambient noise.	2131	KIRCHNER, Wayne Kermit. Attitudes toward employment of older persons.	2144
DAVIS, Robert Harlan. The quantification of drive I: Incentive values of food and water.	2132		
DOEHRING, Donald Gene. The conditioning of muscle action potential responses resulting from passive hand movement.	2132		

LANGNER, Thomas Simon. Normative behavior and emotional adjustment.	2145
LUCK, Juanita Mariella. A study of peer relationships which children in their latency years are observed to form during 25 group therapy sessions.	2145
McBRIDE, Dorothy. The effects of public and private changes of opinion on intra-group communication.	2146
MORAN, Roger Francis. An analysis of industrial and military morale research with implications for assessment of morale on college and university campuses.	2147
SAMENFELD, Herbert William. The effect of acceptance and rejection upon attitudes and participation in a leaderless group discussion.	2147
STEE, Marjorie Jane. Some dimensions and personality correlates of social self insight.	2148

SOCIOLOGY

SOCIOLOGY, GENERAL

BISHOP, Frances Marian. Family crises: an analytic study of problems and crises experienced during a period of two years by eighty-one middle-income families.	2149
FOWLER, Irving Amio. Local industrial structures, economic power, and community welfare: thirty small New York State cities: 1930-1950.	2149
PODELL, Lawrence. American value orientations and the predisposition of personalities to occupational roles.	2150
SHAPIRO, Gilbert. The formulation and verification of a theory of primary social integration.	2151

SOCIOLOGY, FAMILY

MILLAR, JR., John Robert. A study of the changes of divorce legislation in the state of South Carolina.	2151
---	------

SOCIOLOGY, PUBLIC WELFARE

SCHULMAN, Sam. A sociological analysis of land tenure patterns in Latin America.	2152
--	------

SPEECH—THEATER

ADAMS, William Wall. Relationships between the principles of acting and rhetorical delivery in eighteenth-century England.	2152
--	------

AMSTER, Walter W. A comparative study of the breathing and speech coordinations of laryngectomized and normal subjects, including an evaluation of the relationships between the breathing and speech coordinations of the laryngectomized and their judged intelligibility.	2153
CURTIS, Richard Kenneth. The pulpit speaking of Dwight L. Moody.	2154
DUFFEY, Robert Francis. An analysis of the pitch and duration characteristics of the speech of cerebral palsied individuals.	2155
LAMBERT, James David. The effect of frequency filtering on consonant recognition.	2155
LEITH, William Raymond. An investigation of the adaptation phenomenon and certain concomitant voice alterations in stutterers and non-stutterers.	2156
SIKKINK, Donald Elwyn. An experimental study of the effects on the listener of anti-climax order and authority in an argumentative speech.	2157
STARBUCK, Harold Benjamin. Determination of severity of stuttering and construction of an audio-visual scale.	2158
WEISS, Arthur I. Oral and nasal sound pressure levels as related to judged severity of nasality.	2158

ZOOLOGY

BALHAM, Ronald Walter. The behavior of the Canada goose (<i>Branta canadensis</i>) in Manitoba.	2159
CONNER, Robert Louis. A steroid growth requirement for <i>Paramecium aurelia</i> .	2159
DAVIS, LeRoy Thomas. Studies on the nutrition of the fresh water crustacean, <i>Daphnia magna</i> .	2160
GEARY, John Maurice. The Siphonaptera of New York.	2161
GLENN, Stanley. Studies on the cultivation of the avian plasmodia with modifications of the Harvard technique.	2161
GROSS, Paul R. The molecular basis of the surface precipitation reaction.	2162
HANSON, Earl Dorchester. Studies on a nucleo-cytoplasmic system in <i>Paramecium aurelia</i> , variety 4: I. Mutations of the gene and of the cytoplasmic factor. II. Phenotypic variation in relation to type and combination of cytoplasmic particles.	2162
HENSON, E. Bennette. The profundal bottom fauna of Cayuga Lake.	2163

KELSEY, Lewis Preston. The anatomy and skeleto-motor mechanism of the head and prothorax of the larva, pupa and adult of <u>Corydalis cornutus</u> Linn. (Neuroptera; Megaloptera; Corydalidae).	2163	RIEGERT, Paul William. The humidity reactions of grasshoppers.	2166
NEFF, Ruth Ann Hensley. The effects of deoxypentose nucleic acid and other nuclear fractions on <u>Rana pipiens</u> development.	2164	ROWAN, William Boyd. The life cycle and epizootiology of the rabbit trematode, <u>Hasstilesia tricolor</u> (Stiles and Hassall, 1894) Hall, 1916. (Trematoda: Brachylaemidae).	2167
OKPALA, Ikedinachuku. Further studies on the chemotherapy of <u>hexamerium</u> and <u>elongatum</u> malarias in the duck.	2165	WAGNER, Charles Eugene. The fate of denervated taste buds in normal and regenerating barbels of the catfish.	2167
REILLY, JR., Edgar Milton. Origins and distributions of North American birds.	2165	WERNER, JR., William Ernest. The distribution and ecology of the amphibians, reptiles, and mammals of the Thousand Islands Region, New York.	2168

AGRICULTURE

AGRICULTURE, GENERAL

CAPITAL NEEDS OF ILLINOIS AGRICULTURE BY 1975

(Publication No. 9037)

Rudolph James Becker, Ph.D.
University of Illinois, 1954

The problem to which this study is addressed is the expected growth of the United States population to 190 million by 1975. The three related parts of the study purpose are, to get measures of the amounts and changes for 1975 by Illinois agriculture of (1) production, (2) farm physical plant needed, and (3) the non-real estate credit that will be used. The theoretical framework indicates that the demand for food is the ultimate cause, and the expanded production of food is the effect. The general method of the study involves attempts (1) to determine functional relationships between factors involved in the many production and consumption considerations, and (2) to estimate future magnitudes of factors on the basis of the relationships established.

The results of the study show that Illinois' place in the national agriculture of 1975 will be similar to its present position. Illinois will still have a livestock-centered agriculture, and be classed as a corn belt state. Production increases over 1950 will be forty percent for corn, fifty percent for hay, twenty-five percent for soybeans, no increase for oats, and a sixty-three percent decline for wheat. There will be increases of 330 percent for broilers, seventy-three percent for turkeys, fifty-five percent for beef, forty-eight percent for eggs, forty-four percent for lamb and mutton, thirty-six percent for milk, and twenty-five percent for pork, with a decline of twenty-seven percent for chickens.

There will be no increase of land devoted to farming, and an eleven percent decline in the number of farm operators. No innovation in technology is needed. There will be a five hundred percent increase in fertilizer used, and a sixty-five percent increase in lime used. There will be an addition of 63,000 tractors, 28,000 trucks, 34,000 corn pickers, and 4,000 pick-up balers, a small increase in combines, and a decline of 20,000 in the number of automobiles. Other items, such as companion equipment for tractors, milking machines, are expected to increase an average of twenty-eight percent per item.

Building changes are calculated from 1945. Expected increases in numbers of buildings are, for poultry houses, 37,000; for beef sheds, 108,000; for single cribs, 21,000; for double cribs, 29,000; for combination cribs, 24,000; for silos, 14,000; for dairy barns, 6,000; for milk houses, 9,000; for movable hog houses, 514,000. There will be no

increase of grain bins or central hog houses. Expected decreases in numbers of buildings are, for dwellings, 15,000; for general purpose barns, 37,000; for garages, 12,000; for machine sheds, 12,000; for beef barns, 9,000; for miscellaneous buildings, 39,000.

Total production expenses will increase \$401 million (all values at 1950 prices), or 39 percent. This will be made up of, in addition to lime and fertilizer, increases of \$55 million for feed, 23 million for livestock, \$31 million for motor vehicle operation, \$56 million for vehicle maintenance, \$20 million for wages, \$27 million for taxes, \$18 million for interest payments, \$74 million for rent, \$11 million for chemicals, \$8 million for supplies, \$14 million for electricity, \$4.3 million for insurance, and \$3.5 million for veterinary fees.

To help finance the \$1,414 million production expense for 1975, the farmers will borrow from the institutional lenders, having \$236 million outstanding on January 1, 1976, twenty-four percent more than on January 1, 1951.

186 pages. \$2.33. MicA54-2759

CHARACTERISTICS OF SOILS WITH FRAGIPANS IN A PODZOL REGION

(Publication No. 9738)

Frank Jefferson Carlisle, Jr., Ph.D.
Cornell University, 1954

The soils studied are classified in the Mardin and Volusia series. They occur on the glaciated portion of the Allegheny Plateau in southern New York are developed in silty glacial till derived from shale, siltstone, and fine-grained sandstone. Mardin is a moderately well drained Podzol. The associated Volusia soil is somewhat poorly drained and lacks the Podzol horizons. In both soils a dense, slowly permeable horizon, or pan, occurs at a depth of 10 to 20 inches. The purpose of the study was to determine (a) the morphology of the soils and (b) the factors responsible for the observed properties of the pan horizon.

A detailed study of the morphology of the soils and their relation to topography was made along 28 miles of freshly dug pipeline ditch. The upper solum of Mardin is a typical Podzol profile to a depth of about 15 inches. The Podzol is underlain by a light colored coarser textured horizon 3 to 6 inches thick which is designated the A₂ horizon. Below the A₂ is the pan, or B' horizon. It is about 3 feet thick, very firm, dense, and slowly permeable to water. Volusia consists of an A₁ horizon 4 or 5 inches thick underlain by A₂ and B' horizons which are similar to those in Mardin but are more strongly gleyed.

The B' horizon is olive brown compact gravelly

loam or gravelly silt loam. Its consistence varies with moisture content, being very firm when moist and very hard to extremely hard when dry. It has an unusually high bulk density of 2.0 to 2.1. The structure consists of very large prisms 6 inches to 3 feet across which have weak medium blocky interiors. The large prisms have coatings of gray silt loam which appear as vertical gray streaks in an exposed profile. The gray streaks form a polygonal pattern on a horizontal section. Plant roots are present in the gray streaks but not in the interior of the prisms.

Two profiles of Mardin and two profiles of Volusia were sampled for laboratory study. Bulk density, mechanical analysis, base exchange capacity, and exchangeable bases were determined by standard methods. Undisturbed blocks of the soils were impregnated with a synthetic resin ("Castolite"), and thin sections of the blocks 0.025 to 0.035 mm. thick were prepared. The micromorphology of the soils was studied in the thin sections using a petrographic microscope.

Some conclusions drawn from this study are: (1) The A₂ and B' are genetic soil horizons. (2) The B' horizon is morphologically the same kind of horizon as those designated fragipans in other areas of the United States. (3) The high bulk density and slow permeability of the fragipan are due in large part to the deposition of very fine sand, silt, and clay from water suspension in pore spaces of the pan. (4) The fragipan as a whole is slowly permeable and most water movement in the soils is lateral seepage in the A₂ horizon. However, considerable water movement through the pan occurs in the gray streaks which bound the large prisms. (5) The character of the solum above the pan is controlled by the interaction of the pan and topographic position as it affects water relations. (6) Degradation of the pan in Mardin soils is caused by accelerated loss of clay from parts of the pan exposed to very strongly acid solutions moving downward from the Podzol horizons.

127 pages. 1.59. MicA54-2760

STUDIES ON VIRUS DISEASES INFECTING HARDY PRUNUS GROWN IN MINNESOTA NURSERIES

(Publication No. 10,026)

Paul Russell Fridlund, Ph.D.
University of Minnesota, 1954

Studies were made on virus diseases infecting the little-investigated winter-hardy Prunus varieties which are propagated only in North Central States. The principal part of these investigations were on the latent necrotic ring spot virus and Prunus tomentosa as an index host.

When Prunus tomentosa was inoculated with 65 budwood samples from other Prunus species, it produced symptoms of necrotic ring spot about as readily as any of the commonly used index hosts (peach, Montmorency, Kwanzan, and Shirofugan). In addition it detected and differentiated at least two additional

previously unidentified latent viruses, which indicated that it may have greater value in detecting and differentiating latent viruses than some of the other index hosts. The symptoms of necrotic ring spot in Prunus tomentosa were shoot dieback, mottling, necrotic spotting and shotholing of leaves, chlorotic ring spotting, leaf rugosity, and general stunting. No other virus disease inoculated into this species produced symptoms similar to those of necrotic ring spot.

Some of the usual variables caused by diversity in virus, host, and environment were also investigated. Cultures of necrotic ring spot were shown to differ in infectivity and symptom production in Prunus tomentosa and six other species. In thirteen cross-protection tests in Prunus tomentosa seedlings, cross-protection was complete in twelve combinations and partial in the thirteenth. This also indicated that all cultures used were the same virus. Comparisons were made of differences in symptom kind and frequency in potted Prunus tomentosa seedlings, a clone propagated by cuttings, and a clone budded on Prunus americana rootstocks. The results indicated that the individual response of the plants to transplanting may be more important in causing symptom diversity than the genetic differences of individual seedlings. The environmental and cultural practices studied apparently did not increase or decrease the number of inoculated Prunus tomentosa seedlings producing symptoms. High constant temperature (30°C.) produced symptoms more rapidly (6 to 14 days) than a lower temperature (18°C.) (14 to 23 days), and it increased the severity of the shoot dieback and mottle symptoms. Low temperature increased the severity of necrotic spotting. Different ways of pruning Prunus tomentosa had little influence on symptom severity. Inoculations at bud break caused more severe symptoms earlier than comparable "fall" inoculations.

From these investigations it was concluded that Prunus tomentosa seedlings were a satisfactory index host for the necrotic ring spot virus.

Eighteen winter-hardy hybrid Prunus varieties having a wide range in specific parentage were found to be susceptible to the latent necrotic ring spot virus, but the symptoms produced were indistinct. Little natural infection of the varieties was found in Minnesota nurseries, and that found usually had a variety-nursery association. Surveys of random wild Prunus in Minnesota showed that only about 4.5 percent of the trees were infected. This, together with other natural transmission studies, indicated that little natural transmission occurs in Minnesota. Consequently it appears that necrotic ring spot can be readily controlled by the nursery practice of propagation from known necrotic ring spot free mother trees.

131 pages. \$1.64. MicA54-2761

THE EFFECT ON SALES OF SPECIAL
COOKING QUALITY POTATOES
SEPARATED BY SPECIFIC GRAVITY —
CONSUMER ACCEPTANCE IN RETAIL STORES

(Publication No. 9757)

John Ronald Johnson, Ph.D.
Cornell University, 1954

The hypothesis on which this study has been based is that an important segment of the population in a large industrial city desires and is willing to pay for a premium quality potato.

The primary objectives of this study were to ascertain the degree of customer acceptance of potatoes for specific cooking purposes separated by specific gravity; to determine whether and to what extent customers would pay a premium for this market innovation, and to learn what effect the availability of these potatoes separated as to mealiness would have on total potato sales. The principle measurement employed as an index of customer reaction was the retail sales volume of experimental and non-experimental potatoes.

Another objective of this research was to evaluate the added processing costs incurred in the separation and handling of these special purpose potatoes.

These customer acceptance studies were conducted over the marketing seasons, 1951-52 and 1952-53. The reactions of customers to this market innovation were ascertained in 6 large super markets of the Loblaw's Inc. food chain, in Syracuse, New York. These stores averaged about 26,500 customers per week.

The special purpose potatoes offered for sale in these tests were designated as "Baking," "Boiling" and "Blue Tag." The "Baking" classification indicated a high degree of mealiness and was considered best for baking and mashing. The "Boiling" classification being less mealy was well adapted to boiling whole or mashing and was good for scalloping and frying. "Blue Tag" or "Purple Tag" potatoes (as they were designated in the 1951-52 study) were unseparated as to mealiness and represented a check or control sample corresponding roughly to the average lots of New York State potatoes sold in the same test stores and taken from the same bin as were the "Baking" and "Boiling." Potatoes that sank in a salt solution of 1.080 specific gravity were labelled "Baking;" while those which floated in the same solution were classified as "Boiling."

During both seasons "Baking" and "Boiling" sales constituted about 1/3 of the total potato sales in the 6 stores. "Baking" and "boiling" sales were very similar in volume, each lot making up about 15 percent of total potato sales. Sales of unseparated, but washed, "Blue Tag" control lots made up about 17 per cent of the total potato market. Thus, it appears as though a sizeable proportion of the customers accepted the special purpose potatoes readily and were willing to pay premiums for baking and boiling quality potatoes. Customers did not seem to have strong preferences for one type over another when all lots were sold at the same price. The sales of the unseparated control

lot indicate that the preference for clean, unseparated potatoes is of about equal magnitude to that for either baking or boiling quality.

The relationship between sales of experimental and non-experimental potatoes came into sharp focus when sales per 100 customers for both lots was examined. On the basis of sales per 100 customers sales of experimental lots decreased as the price premiums were raised from no premium to 5 and 10 cents per 10 or 15-pound unit. The prevailing price of regular unwashed and unseparated New York, U. S. No. 1 potatoes was always used as the base price. Experimental price premiums were always additive to this base price. A 10-pound experimental package was utilized in the 1951-52 study while a 15-pound container was used in the 1952-53 tests.

Customers exhibited a willingness to pay a 10 cent differential for "Baking" and "Boiling" quality without decreasing their purchases substantially. Sales of "Baking" potatoes decreased more than did "Boiling" sales when price premiums were increased from no premium to 5 and 10 cents per unit of sale. In the 1952-53 study, the combination of premiums that resulted in greatest total sales of all potatoes was when "Baking" and "Boiling" lots were sold at a 10 cent premium while "Blue Tag" was sold at a 3 cent premium.

The total additional costs of separating, washing, drying and packaging separated potatoes was estimated at 19.2 cents per hundred pounds over and above normal costs for putting up regular, unwashed, unseparated New York, U.S. No. 1 potatoes.

295 pages. \$3.69. MicA54-2762

A STUDY PERTAINING TO THE EFFECTS
AND CORRECTION OF DDT PHYTOTOXICITY
TO CUCUMBERS

(Publication No. 9764)

George Butterick MacCollom, Ph.D.
Cornell University, 1954

A preliminary field test made in 1951 showed that activated charcoal was highly effective in reducing the phytotoxicity of DDT dusts to cucumbers. Where charcoal was added to DDT sprays, however, no corrective action was noted. Further field tests were made in 1952 and 1953 to compare the effectiveness of activated charcoal, when used in varying ratios to actual DDT. A ratio of three parts activated charcoal to one part actual technical DDT counteracted the phytotoxic effect to the greatest extent. The yield as measured by the number and weight of fruit was not significantly different from those obtained from 2% purified DDT dust treated, diluent treated, or untreated check plants. A 2% purified DDT dust is less phytotoxic than technical DDT dusts, and the addition of activated charcoal to purified DDT dusts did not result in any appreciable lessening of injury.

Comparative field tests were made in 1952 and 1953 to determine the effect of activated charcoal as a component of DDT sprays on phytotoxicity. These

tests showed that DDT wettable powder spray suspensions, in general, are less phytotoxic to cucumbers than 2% DDT dusts, when the source of the DDT is the same for both the sprays and dusts. The addition of activated charcoal in such sprays failed to result in any appreciable lessening of injury. Use of B-1956 as a sticker, spreader and emulsifier definitely intensifies the phytotoxic effect. Activated charcoal had no effect in altering the deleterious effect of the B-1956. When B-1956 was omitted from the spray, and soybean flour substituted as a sticker, the injury was, in degree, similar to that caused by the DDT suspension without additives.

Five weekly applications of a 2% technical DDT dust with and without activated charcoal were made to five varieties of cucumbers, A and C, Marketer, Niagara, National Pickling, and Yorkstate Pickling. The response of these five varieties as measured by the number and weight of fruit produced, shows that the activated charcoal causes a significant increase in yield on all varieties except Yorkstate Pickling.

The impurities present in technical DDT were given consideration as the possible cause of injury. A greenhouse test was made where potted cucumbers were sprayed with the filtrates from a DDT wettable powder and from a 100% technical DDT ground in sand. These filtrates produced no injury to the plants, but the resuspended residue from the wettable powder caused severe injury.

The major constituents of technical DDT found in excess of 0.6% were applied in an acetone-Triton X-100 spray to young cucumber plants. The compounds were applied at three times the concentration they are found in the technical material. Growth of the plants showed that DDT injury is primarily associated with the ortho para and para para isomers of DDT. A further test, where the two isomers were applied at equal concentrations, showed the ortho para isomer to be approximately twice as phytotoxic as the para para isomer.

A series of tissue analysis studies were made in 1952 and 1953 to determine if the DDT, acting as a botanically active chemical, inhibited the normal uptake of one or more elemental nutrients. Results of two years work indicated, in general, an accumulation of nitrate nitrogen, and a depression of calcium in the chlorotic foliage of DDT treated plants as compared to the normal foliage of untreated plants.

A series of laboratory tests were made on two insect species to determine differences between a DDT wettable powder suspension with and without the addition of activated charcoal at a ratio of three parts charcoal to one part actual DDT. The results obtained from these studies show that activated charcoal reduces the toxic insecticidal contact effect of DDT to the pea aphid and to the southern armyworm. The toxic insecticidal stomach action effect of DDT to the southern armyworm, however, is not altered by the addition of activated charcoal.

110 pages. \$1.38. MicA54-2763

RETIREMENT FARMING IN HILLSBOROUGH COUNTY, FLORIDA

(Publication No. 9717)

Fred Richard Marti, Ph.D.
University of Florida, 1954

Population specialists stress the growing importance of the problem created by citizens 65 years of age or over, now 1 in 12 as against 1 in 25 in 1900, particularly as (1) they are becoming a larger proportion of the total population, and (2) are imposing upon society a responsibility for their welfare. Insofar as the Florida situation can be projected, it appears that the burden of the care of older people will not fall any more heavily upon the citizens of the State than upon the citizens of the United States. However, the rapid population growth of Florida will result in a rapid increase in the number of retirees locating in the State. Therefore it is desirable to determine what retirees can do to supplement retirement incomes that may prove to be inadequate. In this respect retirement farming may assume an important role in maintaining or increasing the well-being of retirees.

This dissertation deals with a study of 104 persons who had retired and were doing some kind of farming in Hillsborough County, Florida in 1952. The study was made to obtain data that would be particularly helpful to County Agents and other agricultural specialists in making recommendations for guidance of retired persons engaged in farming.

The specific purposes of the study were to determine (1) the contributions of retirement farming to the welfare of the retired people, and (2) the factors that influence the contributions of retirement farming to the welfare of retired people.

The working hypothesis was based on the fact that if retirement incomes were too low to provide an adequate level of living, then such levels of living could be augmented through retirement farming.

In making this study it was recognized that retirement farmers differ from the commercial farmer in that they do not have the same desires or incentives. For example, commercial farmers usually farm for economic reasons, whereas subjective values are important in determining how retirement farmers operate their farms. Most retirees are not trying to accumulate capital. They are trying to obtain an income sufficient to meet their needs. If they have little or no retirement income, they find it necessary to supplement their incomes from other sources.

The results show that retirement farming under the conditions which existed in Hillsborough County in 1952 was a desirable undertaking for many retirees. It provided opportunities to reduce living costs, supplement retirement incomes, and satisfy subjective urges. However, it had limitations, as debilities and physical afflictions reduced the vitality of retirees.

As a general recommendation, the writer suggests that retirees consider locating on small acreages in or near villages rather than in the open country. This recommendation is based upon the facts that

only about half of the retirees interviewed owned automobiles and some could not drive at night; few had telephones; medical assistance was difficult to obtain; disabilities precluded extensive physical labor; and the need for companionship was in evidence. Able-bodied retirees with ample resources who want to farm may be justified in farming on a commercial basis in the open country. 199 pages. \$2.49. MicA54-2764

A STUDY OF THE FERTILITY STATUS OF THE COCOA AND COFFEE SOILS OF COSTA RICA

(Publication No. 9925)

Fenton Bertrum Sands, Ph.D.
Cornell University, 1954

During the spring of 1953, soil and leaf samples from coffee and cocoa farms in Costa Rica were collected. The objective was: to determine by physical and chemical analyses the fertility status of these soils, to ascertain what factor or factors were associated with high and low production, to see what correlations, if any, existed between the chemical analysis of the soil and chemical analysis of the leaves of coffee and cocoa and, to lay the ground work for future soil and leaf nutritional studies.

Soil samples were taken to a depth of two feet. The following were determined on each soil sample: total nitrogen, moisture equivalent, base exchange capacity, pH, per cent base saturation, total exchangeable bases, replaceable calcium, potassium, magnesium and manganese, soluble zinc and hot water soluble boron. The leaf samples were analysed for all of the above cations plus phosphorus.

When the cocoa and coffee soils were contrasted, it was found that the coffee soils had a much wider range in all properties than the cocoa soils. This was believed due to the fact that the soils devoted to coffee production were derived from recent alluvium, lacustrine deposits and volcanic material, all of which were found in different stages and degrees of weathering. The cocoa soils, by way of contrast, were all coastal alluvial soils which had been exposed to the soil forming processes for approximately the same length of time. The average total nitrogen was 42% higher in the coffee soils than in the cocoa soils. This was attributed to the slower rate of organic matter decomposition in the cool upland coffee regions than in the hot, humid, lowland cocoa region. On the average, the per cent of base saturation in the cocoa soils was 83 per cent, while it was 36 per cent in the coffee soils. Soil age was thought to be the factor responsible for the difference. The exchange capacity, pH and moisture equivalent were similar in the two soil groups, but the clays in the upland coffee region appeared to be different in kind and less active than those in the coastal soils.

A relatively high state of fertility was found in the coastal alluvial (cocoa) soils. The data from the major cocoa producing districts tended to indicate that there were similarities as well as differences

to be found between districts. The nutritional status of the coffee soils was found to be quite variable. The alluvium and young volcanic soils had relatively high averages for all cations, while the latosols had very low averages, particularly in some areas.

The cocoa rooting study showed that the physical condition of the soil appeared to be, in many places, the limiting factor to production and not the nutritional status of the soil. Cocoa rooting was found to be limited by mechanical barriers, improper surface drainage and poor internal drainage.

Significant relationships were found to exist between soil and leaf analyses in coffee with calcium, magnesium and potassium. However, this did not appear to be the case with cocoa. No relationships were found between the soil and leaf analyses for manganese, boron and zinc in both crops. The seasonal study on the cocoa and coffee leaves showed that the physiological age of the leaf had a pronounced effect on the mineral content of the leaves. In the cocoa leaf, nitrogen, potassium and phosphorous concentrations per cent dry weight decreased with age. Calcium increased with age, while magnesium, manganese, boron and zinc concentrations did not reflect consistent changes with leaf age. As the coffee leaf matured, nitrogen, potassium, boron, zinc and phosphorous concentrations decreased. Calcium and manganese increased, while magnesium tended to remain constant.

213 pages. \$2.66. MicA54-2765

AGRICULTURE, ANIMAL CULTURE

FACTORS WHICH AFFECT THE UTILIZATION OF RATIONS HIGH IN CELLULOSE

(Publication No. 9173)

Coy Clifton Brooks, Ph.D.
University of Missouri, 1954

1. Introduction

Many feeds for cattle and sheep are high in cellulose but specific requirements for optimum cellulose breakdown in the rumen can not be qualitatively or quantitatively determined from the literature existing today. Very few of the factors that are believed to influence cellulose digestion have been adequately tested in the intact animal or measured under conditions compatible with feeding and management.

This work was designed to:

1. Determine the sources and optimum of energy needed to stimulate cellulose digestion in rations low in N.F.E.
2. Measure the effect of certain steroid compounds on cellulose digestion.
3. Identify certain mineral elements which are believed to stimulate cellulose digestion.

2. Procedure

Six trials involving 146 artificial rumina were conducted. The effect on cellulose digestion of adding the following substances, at the given per cent of dry matter in the ration, was studied: molasses at levels ranging from 4 to 16 per cent; corn oil, 1 to 17 per cent; corn starch, 4 per cent; lactose, 4 per cent; stilbestrol, 2 to 20 ppm; estrone, 20 ppm; cholesterol, 20 ppm; alfalfa ash, 2 per cent; and several mineral mixes combined to include substances known to be present in alfalfa ash.

Some of the substances that appeared to have the greatest influence upon cellulose digestion were studied further in two digestion trials with twenty yearling crossbred wethers. The factors studied in the sheep included molasses at the level of 6 and 12 per cent of the ration; corn oil and lard each at 3 and 6 per cent of the ration; corn at 5 per cent of the ration; this level of corn plus 1 per cent urea; alfalfa ash at 2 per cent of the ration and stilbestrol at 10 and 20 ppm in the ration. The basal ration consisted of 2 pounds of cottonseed hulls and 94 grams of casein plus vitamin A and minerals.

3. Summary

Molasses at low levels (4 to 6 per cent) increased while molasses at high levels (10 to 12 per cent) reduced cellulose digestion in both the artificial rumen and the sheep. Corn starch or lactose at the 4 per cent level failed to change cellulose digestion in the artificial rumen. When 5 per cent corn was added to the ration of sheep cellulose digestion was lowered slightly. When corn plus urea were added to the basal ration, cellulose digestion was no different from the basal.

All levels of corn oil tested lowered the cellulose digestion significantly in the artificial rumen. The two levels of corn oil tested in the sheep lowered the digestion of cellulose and the sheep lost more weight than on the basal ration alone. Lard decreased cellulose digestion and the rate of gain in sheep. It is concluded, therefore, that corn oil or lard should not be added to a sheep ration containing large amounts of course roughage such as cottonseed hulls.

Stilbestrol, estrone and cholesterol added at levels of 10 to 20 ppm significantly increased cellulose digestion in the artificial rumen. Stilbestrol increased the coefficient of digestion of cellulose and protein in the sheep but could not be tolerated by the sheep.

Alfalfa ash increased cellulose digestion in the artificial rumen in all tests but did not show any beneficial effect in the sheep except when the ration contained fat. There was a slight decrease in cellulose digestion when alfalfa ash was added to the basal alone or the basal plus molasses.

Mineral mixes, including calcium, phosphorous, magnesium, manganese, potassium, sodium, copper, boron, zinc, iron, cobalt, chlorine and iodine, failed to increase cellulose digestion in the artificial rumen. When 25 ppm of cobalt chloride was added, cellulose digestion was decreased, but when 5 ppm was added there was an increase in cellulose digestion.

These investigations indicate that the adding of minerals indiscriminately to high fiber rations for sheep might result in lower cellulose digestion.

113 pages. \$1.41. MicA54-2766

A STUDY OF THE PROTEIN NEEDS OF FATTENING LAMBS FED SHELLED CORN, VARIED AMOUNTS OF CORN SILAGE AND ALFALFA HAY, AND TRACE AMOUNTS OF COBALT AND COPPER

(Publication No. 9910)

Leon Fredric Bush, Ph.D.
Cornell University, 1954

Three experiments were conducted with 330 western feeder lambs, ranging in weight from 38 to 75 pounds. In each experiment, a 3 x 3 factorial arrangement of 9 lots of 11 lambs each was used to determine the relative efficiency of various rations with a total protein content, air-dry basis, of 10.0, 11.0, and 11.8 per cent. This design, also, makes it possible to compare the feed-lot performance of lambs getting corn silage as the only roughage with similar lambs fed 0.75 and 0.50 pound of alfalfa hay and a full feed of corn silage. In addition, one lot of eleven lambs was fed to study the value of adding trace amounts of cobalt and copper to rations for feeder lambs. These comparisons were made with rations containing about 10.1 per cent total protein and 0.75 pound of alfalfa hay per lamb daily.

The lambs in all lots were full fed shelled corn and corn silage. The level of protein was controlled by adjusting the amount of linseed meal added to the ration. A calcium-phosphorous ratio of approximately 2 to 1 was maintained in the rations by adding ground limestone when necessary. The measures of performance were the rate of gain, feed efficiency, finish or fatness, and net return per lamb over the cost of lamb and feed.

The average daily gain made by lambs fed rations with an average protein content of 11.8 per cent was 0.371 pound, while the average daily gain made by similar lambs fed rations that contained 10.0 and 11.0 per cent protein were 0.351 and 0.353 pound, respectively. The lambs fed the 11.8 per cent protein ration made significantly ($P < .05$) larger gains than those fed a ration with 10.0 per cent protein. The difference in rate of gain made by lambs fed a ration containing 11.8 and 11.0 per cent total protein, approached significance.

Lambs fed rations with the medium level of protein were significantly ($P < .05$) fatter at the end of the experiment than those fed more protein. The average grade on foot for the lambs fed rations with 11.0 per cent protein was 3.23 (prime - 4; choice - 3; good - 2; utility - 1), while the average grade on foot for those fed rations that contained 10.0 and 11.8 per cent total protein was 3.06 and 2.94, respectively.

There was little difference in the feed efficiency of the lambs fed various levels of protein. The feed cost per 100 pounds of gain was the highest for lambs

fed the medium level of protein. Lambs fed the highest level of protein returned a little more profit than those fed less total protein.

The amount of hay in the ration did not influence significantly ($P > .05$) the rate of gain or degree of finish of the lambs. However, lambs fed 0.50 pound of hay with a full feed of corn silage gained slightly faster, were fatter, and returned more profit than lambs fed 0.75 pound of hay and those fed corn silage as the only roughage. The cost per 100 pound of gain decreased as the amount of silage in the ration was increased, and was the lowest for the lambs fed corn silage as the only roughage. The difference in the total air-dry feed required per 100 pounds of gain for the three levels of hay and corn silage was highly significant ($P < .01$). Feed efficiency was increased significantly ($P < .05$) with each increase in corn silage in the ration.

The addition of trace amounts of cobalt and copper to a ration with about 10.1 per cent total protein and 0.75 pound of alfalfa hay and a full feed of corn silage did not influence the rate of gain or the degree of finish. The lambs fed a ration with trace amounts of cobalt and copper required less concentrates per unit of gain, had a lower feed cost, and made more profit than lambs fed a ration with the trace minerals added. In areas of New York State where a deficiency of cobalt has been demonstrated, the supplementation of a ration with this mineral would elicit a response in feed-lot performance.

78 pages. \$1.00. MicA54-2767

STUDIES OF THE LEUCINE AND HISTIDINE REQUIREMENTS FOR GROWTH OF SUCKLING PIGS

(Publication No. 9912)

Robert Glenn Eggert, Ph.D.
Cornell University, 1954

Experiments were conducted with young pigs concerning their requirements for the amino acids leucine and histidine for growth. All pigs were removed from the sow at about two days of age (in some cases somewhat older) and kept individual, battery-type cages in a warm, draft-free room. Feed consumption was essentially *ad libitum*.

Two experiments were conducted to study the quantitative L-leucine requirement of suckling pigs fed simulated "milk" diets containing sufficient nitrogen to be equivalent to 25 per cent of the air-dry diet as protein. The dietary nitrogen was supplied by casein, purified amino acids, and diammonium citrate. Growth and feed efficiency were used as the criteria of measuring the effects of adding the various levels of L-leucine in both experiments. In addition, carcass storage of protein, fat and ash were determined for all pigs in the second experiment. The data indicate that the L-leucine requirement of suckling pig is more than 1.00 but not more than 1.25 per cent of this type of diet.

Two small experiments were conducted with

young Yorkshire pigs fed diets in which the dietary nitrogen was furnished by purified amino acids, diammonium citrate and, in the second experiment, one per cent of monosodium glutamate. Those pigs which received all ten of the amino acids which are required for the growth of the weanling rat grew at a fairly rapid rate, although growth was not as rapid as would be expected on a diet in which the same amount of nitrogen would be furnished by casein, while those pigs receiving the same diet minus histidine failed to grow normally. When histidine was added to their diet, these pigs showed greatly increased appetites and resumed growth almost immediately. It was concluded that histidine is required for the normal growth of young pigs.

An additional experiment was conducted using a basal diet in which part of the dietary nitrogen was furnished by casein. This diet was known to be adequate for very good growth of young pigs provided supplementary amounts of the essential amino acids and sufficient total nitrogen were furnished. This experiment was designed to see if such a diet without added histidine would be low enough in histidine content to be used for a quantitative study of the histidine requirement of the young pig. Supplementary amounts of the ten amino acids known to be required for the growth of the weanling rat were added to one diet, while the same amino acids minus histidine were supplied to the other diet. One per cent of monosodium glutamate was supplied in each diet, and sufficient diammonium citrate was added to equalize the nitrogen content of each diet at a level equivalent to 20 per cent of the air-dry diet as protein. The results indicated that the basal diet was not low enough in histidine content for a critical study of the histidine requirement of the young pig, and that the requirement of the young pig for histidine is probably not much, if any, higher than 0.3 per cent of such a diet.

A comparison of the data from this last experiment with data from previous experiments points out a need for a controlled investigation of the degree of utilization of non-protein nitrogen substances, such as diammonium citrate, in substituting for non-essential amino acids in experimental diets of young pigs.

96 pages. \$1.20. MicA54-2768

A STUDY OF SOME FACTORS AFFECTING SHEEP PRODUCTION

(Publication No. 9179)

Paul Quentin Guyer, Ph.D.
University of Missouri, 1954

Tests were conducted in 1951-52 to study some of the factors affecting sheep production under practical farm conditions. Sixty-three large two-year-old Northwestern ewes were divided into uniform groups for the 2 x 2 factorial experiment. The ewes were bred for early lambs--half to a large Hampshire ram of acceptable conformation and the others to a small Hampshire ram of superior mutton conformation. Half the ewes bred to each ram subsisted on winter pasture during gestation except that hay was fed

fed when weather conditions prevented grazing; the other ewes were fed, in addition, 2 pounds of concentrates per head daily the last sixty days of pregnancy. All ewes were managed alike after lambing, as recommended for commercial lamb production. Milk yields were determined over a twenty-four-hour period each week for the first nine weeks of lactation and other production data were secured. Pertinent observations follow:

1. High production was obtained from extensive use of pasture and roughage.
2. Both bluegrass and fescue-ladino winter pastures were adequate nutritionally during gestation for the mature ewes, in good flesh at conception, utilized in these tests.
3. Adding a liberal allowance of concentrates during the last sixty days of pregnancy to a ration of bluegrass pasture had beneficial effects, i.e., greater gains of the pregnant ewes, heavier fleeces, larger lambs at birth, greater milk yields, heavier lambs at sixteen weeks and marketing of lambs at younger ages and higher prices. However, the increased production did not increase financial returns enough to pay for the additional concentrates fed.
4. Feeding concentrates in late pregnancy when fescue-ladino was the winter pasture had less beneficial effects.
5. Fescue-ladino pasture excelled bluegrass for wintering pregnant ewes.
6. Dystocias occurred in about 11 per cent of the ewes but could not be associated with either differences in size and type of sire or conformation of ewes; no lambs were lost as a result of the dystocias.
7. The following effects of large and small sires on their lambs were noted:
 - a. Singles by the large ram were larger at birth and marketed at younger ages.
 - b. Twins by the small ram were heavier at sixteen weeks and marketed at younger ages.
 - c. Lambs by the small ram shrank less en route to market, sold and dressed higher and yielded heavier carcasses. Carcasses of these lambs graded higher in 1953 while in 1952 the differences were negligible.
8. It is believed that large size of the ewe was of more importance than size of ram in fat lamb production.
9. Growth rates of lambs were highly associated with milk intake, number of lambs nursed and birth weight. Milk intake accounted for approximately 70 per cent of the variation in the growth rate of lambs; thus, factors which may contribute to higher milk yields merit further studies.
10. Heavy fall yearling weight of dams was associated with the production of fast growing lambs.
11. Wether and ewe lambs grew at about the same rate.
12. The peak in milk production usually occurred the second week and declined thereafter to the ninth week of lactation. Ewes producing more than one lamb had higher average milk yields than ewes producing singles.

163 pages. \$2.04. MicA54-2769

GENETIC VARIATION AND COVARIATION IN RATE OF MATURITY AND LEVEL OF PRODUCTION IN DAIRY CATTLE

(Publication No. 9796)

Charles Garner Hickman, Ph.D.
Cornell University, 1954

Records collected under the Dairy Herd Improvement program in New York State were used to estimate the importance of differences in rate of maturity in selection programs. Paired lactation records were available on 3,912 cows between the ages of 18 and 48 months when first fresh. Rate of maturity was measured by age at first freshening and by increase in age-corrected milk and fat production from first to second lactation. Level of milk and fat production and the rate of maturity measurements were subjected to analyses for the estimation of variance components for sire, herd, herd x sire, herd x time period, and residual variation.

The difference traits were found to be about one-quarter to one-third as variable genetically as was level of production. This relationship held with changes in the statistical model used.

A herd x sire element in the statistical model accounted for a large portion of the residual variation but when a herd x time period element was simultaneously included the variance for herd x sire became negligible in magnitude. This is explainable by the fact that the use of sires is confounded with time and there exists a large herd x time period interaction. This confounding exists within years as was determined by a X^2 test of the disproportionality of sire progenies over seasons and strongly biased upward estimates of the sire variance for age at freshening. Since yearly trends in age at freshening were not large, a general factorial analysis including year-seasons as a random variable yielded the most reliable variance estimates for age. Similar analyses were unsatisfactory for the production traits because with these there was marked variation among years and the assumption of the year-season effect being a random variable was invalid. A within-year analysis proved most satisfactory for production traits.

Heritability estimates ranged from .21 to .64 and .26 to .56 for milk and fat production respectively; .05 to .24 and .06 to .19 for milk and fat difference respectively; and .05 to .12 for age at freshening. The estimates increased in size with increased correction of the data for environmental factors.

Biases in estimates of variances for the difference traits due to disparity in rate of selection among sire progenies and herd members were found to be non-existent in the sire variance but large in the herd variance.

Although small genetic differences were found to occur in rate of maturity as measured, the possibility of genetic changes in rate of maturity by selection for high first lactation production was investigated. Estimates of genetic correlations between level of production and increase from first to second lactation production indicate the true genetic correlation to be either zero or slightly positive. The genetic

correlation between age and the increase was estimated as being positive, but this estimate is biased upwards because the age correction factors used are too large for first and too small for second lactation production. Similar correlation estimates among herds were found to be strongly negative.

The estimated genetic correlations indicate that regardless of level of production for sire progenies the increase in production from first to second lactation is the same. Thus, the use of only first lactation records for sire selection would not be expected to change, in later generations, length of productive life or level of production by lactation. On the other hand, the highly negative correlation for level and increase in level of production among herds indicates a need for studying age correction factors and length of productive life in relation to level of herd production.

106 pages. \$1.33. MicA54-2770

THE METABOLISM OF COBALT,
VITAMIN B₁₂, INTRINSIC FACTOR,
LEUCOVORIN, AND AUREOMYCIN
BY COBALT-DEFICIENT LAMBS

(Publication No. 9919)

Conrad John Kercher, Ph.D.
Cornell University, 1954

The liver and gastro-intestinal contents of 1 normal and 10 cobalt-deficient lambs were assayed for vitamin B₁₂ using *Lactobacillus leichmannii* ATCC 4797. The concentration of vitamin B₁₂, expressed in micrograms per 100 grams dry matter, was 310 in the liver, 60 in the rumen-reticulum, 29 in the omasum-abomasum, 49 in the duodenum-jejunum, 103 in the ileum and 170 in the cecum of normal sheep compared to 7 in the liver, 4 in the rumen-reticulum, 2 in the omasum-abomasum, 4 in the duodenum-jejunum, 7 in the ileum, and 11 in the cecum of cobalt-deficient sheep. Indirect evidence indicates that vitamin B₁₂ is apparently absorbed from the omasum-abomasum and possibly to some extent from the first segment of the small intestine. The increase of total vitamin B₁₂ in the cecum of both normal and deficient sheep indicates that synthesis of vitamin B₁₂, presumably bacterial, occurred in the lower intestinal tract.

An extract of pseudo-vitamin B₁₂ produced by an isolated rumen micro-organism was found to be physiologically inactive when administered parenterally to cobalt-deficient sheep. The lower level of B₁₂ in the blood of the animals that received pseudo-B₁₂ compared to the animals that received a similar quantity of crystalline B₁₂ suggests that the pseudo-B₁₂ was rapidly excreted or destroyed. The rapid rise in vitamin B₁₂ in the blood following oral cobalt administration suggests that the rumen B₁₂-synthesizing micro-organisms respond rapidly to the introduction of cobalt.

The simultaneous oral administration of intrinsic factor and a suboptimal level of vitamin B₁₂ is no

more effective than the oral administration of the suboptimal level of vitamin B₁₂ alone in curing cobalt-deficiency. This does not necessarily mean that a source of intrinsic factor is not needed by sheep for the absorption of vitamin B₁₂. The intrinsic factor administered orally may very well have been destroyed or changed by the rumen microflora before it reached its site of action in the lower alimentary tract.

The level of vitamin B₁₂ in the blood of sheep on a cobalt-deficient ration was found to decrease rapidly, although the lambs continued to eat well and gained weight for some time after the level of B₁₂ in the blood declines. This suggests that tissue vitamin B₁₂ is conserved tenaciously. It would seem that the reduced level of vitamin B₁₂ in the blood could be used as a specific symptom of cobalt deficiency in ruminants.

The administration of cobalt orally to cobalt-deficient lambs significantly increased the vitamin B₁₂ level in the blood, kidney, pancreas, adrenals, rumen-reticulum, omasum-abomasum, duodenum-jejunum, and ileum. The total vitamin content was significantly increased in the liver, kidney, pancreas, adrenals, rumen-reticulum, omasum-abomasum, ileum, cecum and large intestine of the lambs that received cobalt orally. The parental administration of cobalt to the deficient lambs failed to increase the vitamin B₁₂ level in the blood and body tissues. However, the vitamin B₁₂ content in the cecum and large intestine was significantly increased, presumably as a result of bacterial synthesis following the excretion of cobalt into the duodenum via the bile.

The parenteral administration of leucovorin at levels of 71 micrograms, 5 milligrams, or 15 milligrams daily was ineffective in curing cobalt deficiency. This suggests that the major function of vitamin B₁₂ in curing cobalt deficiency is not the conversion of folic acid to its active form of folinic acid. The oral administration of 10 milligrams of aureomycin HCl was also ineffective in curing cobalt deficiency. Thus, it would seem that with extreme cobalt-deficient lambs aureomycin does not spare the vitamin B₁₂ requirement appreciably nor does it increase vitamin B₁₂ synthesis appreciably.

116 pages. \$1.45. MicA54-2771

THE CHEMICAL ESTIMATION
OF PROGESTERONE IN BLOOD

(Publication No. 9195)

James Inglis Raeside, Ph.D.
University of Missouri, 1954

A chemical method is described for the determination of progesterone in blood, based on extraction and partition between organic solvents, final separation by partition chromatography on filter paper, and ultimate measurement by ultraviolet absorption spectrophotometry. With a system of petroleum ether - 80% methanol on filter paper, progesterone was separated clearly from Δ^4 - androstene - 3,17 -

dione and testosterone. Recovery experiments with crystalline progesterone added to plasma indicated that approximately 75% was recoverable by the entire procedure, when estimated spectrophotometrically with a Beckman Model DU.

The hormone was found in a pregnant goat in blood from the venous drainage of an ovary containing a corpus luteum (approximately 2 μ g/ml plasma). It was present also in blood from the vein of the other ovary, which contained a Graafian follicle but no visible corpus luteum. Progesterone could not be detected in blood from the venous drainage of the uterine horns, pregnant and non-pregnant, in two pregnant goats. Neither was it found in the peripheral blood from two pregnant, and two non-pregnant goats, two pregnant cows, an open heifer, a steer, nor in that from two castrated male sheep.

The concentration of progesterone in the circulation was examined after injection subcutaneously of 1 gm. into a non-pregnant heifer. The data suggest a rapid "disappearance" from blood, with a possible peak concentration (approximately 1 μ g/ml. of plasma) about two hours following the administration of the hormone as a solution in oil. Similar, but continued treatment may have established a detectable plasma progesterone level in a pregnant cow receiving daily injections of 1 gm. of the hormone for more than a week. It is thought that a technicality explains best the sustained effect; the hormone tended to crystallize from the supersaturated solution in oil at the time of injection.

140 pages. \$1.75. MicA54-2772

A STUDY OF THE METABOLISM OF METHYL- C^{14} -METHIONINE IN THE CHICK

(Publication No. 9142)

John Titus Sime, Ph. D.
University of Illinois, 1954

Diets either complete or deficient in methyl groups were fed to four week old chicks for 7-10 days. At the end of this preliminary feeding period, the chicks were operated upon in order to insure the collection of urine free from feces contamination. Eight to ten hours post-operative, 40-100 mg methyl- C^{14} -methionine was injected intraperitoneally and respiratory CO_2 and urine were collected for 48 hours.

Following this collection period, the chicks were killed and analyzed for C^{14} distribution. The choline of the normal chicks contained 1.12% of the C^{14} dose while choline from methyl deficient chicks contained 10.45%. Of the remaining C^{14} , the greatest concentration was found in the carcass (approximately 40%) followed by urine (approximately 20%) and CO_2 (15%).

The uric acid excreted in the urine was found to total 50% of the urinary radioactivity. In order to determine the location of this labeling in the molecule, samples of uric acid were degraded. Carbons 2 and 8 were found to contain 55.9% and 36.5% re-

spectively of the total uric acid labeling. The remaining activity was 0.94% for carbon 6 and 6.7% for carbons 4 and 5. It had been shown previously that formate was a precursor for carbons 2 and 8. These results demonstrate that methionine is also such a precursor and functions as a major source of 1-carbon fragments in the body. The C^{14} labeling of carbon 6, which is known to result from CO_2 fixation, again demonstrates, along with the results for one analysis, that the methyl group is not utilized as $C^{14}O_2$. The labeling in carbons 4 and 5 suggests some biosynthesis of glycine. This is probably not significant since the ethanolamine moiety is not labeled in the isolated choline.

Carbon 2 was found to be incorporated with less dilution than carbon 8, supporting the work of other investigators that carbon 2 is the final addition to the molecule of uric acid. The ratio of labeling in carbon 2 as compared to carbon 8 was found to be 1.53 to 1.

In order to determine the compounds containing the remaining 50% of the urinary activity, paper chromatography was employed. The urine was extracted with phenol and ethanol- H_2O , paper strips developed and radio-autographs prepared. The R_f values of 25 unlabeled compounds known to contain the 1-carbon fragment were determined using the same solvent systems. By this method creatine-creatinine (approximately 15%) and methionine (approximately 5%) were shown to contain the label. However, 25% was found in three unknown compounds that could not be identified by comparison of R_f values or by common chemical spot tests.

89 pages. \$1.11. MicA54-2773

THE EFFECT OF MANGANESE ON THE HISTOLOGY AND ORGAN WEIGHTS OF CATTLE AND THE RAT

(Publication No. 9899)

Theodore Joseph Urban, Ph. D.
Purdue University, 1954

Major Professor: F. N. Andrews

The effects of varying levels of manganese, iron and copper were studied in twelve groups of rats totaling 116 animals.

No changes in histology of the liver, kidney, testes, heart, ovary, epididymis, adrenal, thyroid, and pituitary were observed in any of the experimental groups of rats. The spleen, however, presented some early indications of splenic anemia in rats on high or low iron diets. In the rat, no irregularities were observed in any of the animals receiving high or low levels of manganese.

Five groups of bulls comprising a total of thirty-eight animals were studied in an effort to establish whether any observable changes could be produced by feeding high or low levels of manganese in the diet. In two of the groups, two animals with a high

level of manganese in the diet showed a delay in the onset of spermatogenesis as evidenced by histological examination. The level of manganese fed to these high manganese bulls was the addition of 2.5 grams of manganese sulfate monohydrate per day per bull. Further work is necessary to establish whether this is a true effect of the high manganese ration since these same levels in the three other bovine groups did not clearly cause this same phenomenon. In two other groups three animals under 150 days of age presented a picture of colloid goiter. There were no histological changes observed for the bulls fed the low, 7.4 ppm., level of manganese diet. These bulls seemed normal in all ways. Growth weights of the bulls were similar on all diets and no differences related to manganese deficiency were observed.

126 pages. \$1.58. MicA54-2774

AGRICULTURE, FORESTRY AND WILDLIFE

SOME CAUSES AND EFFECTS OF WATER LEVEL FLUCTUATION IN ARTIFICIAL MARSHES IN NEW YORK STATE

(Publication No. 9736)

Harlan Brown Brumsted, Ph. D.
Cornell University, 1954

Fluctuation of marsh water levels is a primary factor limiting waterfowl and muskrat production. The classic example of the effects of extreme recession on waterfowl is the heavy drought-induced losses of flightless young in the early 1930's throughout wide areas in prairie states and provinces. Even commonly occurring conditions of low water in late summer jeopardizes broods and has a selective effect on late-nesting species. Low water conditions may result in drastic reductions in muskrat populations. In spite of its importance, water level fluctuation has been studied little.

Early investigations revealed summer recession which varied from 0.5 to 2.5 feet between marshes in a single northwestern county. In 1952, extreme recession in many sites in this region resulted in poor survival of liberated juvenile waterfowl.

Objectives of this research were to describe spatial and temporal variation in water level fluctuation, analyze principal factors causing fluctuation, and describe some effects of fluctuation on the marsh biota. Methods included determination of the relative frequencies of precipitation amounts and excessive storms, correlation of recession and progression of levels in four study sites with pan evaporation and precipitation, and plot and transect studies of vegetation. Investigations centered in three northwestern and two south-central counties, and were conducted in 1952 and 1953.

Marked recession characterized plains sites dur-

ing the growing season; in 1952 extremes of 24 to 30 inches were observed. In plateau sites, levels fluctuated only a few inches from normal water level, and in late summer of 1953 under local drought conditions, maximum departures below the normal level were only 8 to 12 inches. Many plains sites were not recharged completely until late winter, whereas plateau marshes refilled in the fall.

These observations are believed to characterize the pattern of fluctuation in these two major physiographic regions. Factors contributing to the differences in water level behavior are the higher precipitation, lower evaporation, and greater amounts of inflow seepage which are characteristic of plateau conditions.

From the empirical relationships between recession and pan evaporation, and progression and precipitation, a method for estimating pond levels was developed.

Flooding results in the transposition of aquatic emergent and wet-land communities from the lowest portion of the basin to the vicinity of the full pond level. Recession early in the growing season promotes development of relatively wide zones of wet-land communities. Analysis of brood flying dates suggests that low water conditions in the plains region may have a selective effect on the wood duck.

235 pages. \$2.94. MicA54-2775

THE GROWTH PATTERNS OF THINNED AND UNTHINNED FOREST STANDS AND THEIR VALUE IN THE MANAGEMENT OF THE FOREST

(Publication No. 9613)

Otis Frederick Hall, Ph. D.
University of Minnesota, 1954

Adviser: Arthur E. Schneider

The central purpose of this study is to determine the place of thinning in managing forests for pulpwood, especially in the Lake States region. Rising pulpwood costs and a demand for pulpwood in this region much in excess of the presently available supply raise the possibility that more intensive forest management thru thinning may be economically feasible.

Although the ultimate objective is an economic evaluation, considerable attention is given to the biological results of thinning, as found in a survey of the literature, and also thru several field experiments. It is concluded that, after thinning reduces competition, the individual tree increases its rate of total volume increment, largely thru increase in diameter growth. Rate of height growth is much less influenced by thinning, and tree form may be slightly modified by greater proportional allocation of growth toward the base of the tree.

Stand growth is analyzed in a generalized diagram showing the relationships of net growth, mortality, gross growth, yields thru thinning, and current and mean annual increment. A theoretical conclusion is

reached that the rotation of maximum mean annual increment is longer in thinned stands than in unthinned stands. Twenty-one indices of stand density are examined and the conclusion reached that basal area, closely followed by stand density index, is the best measure to use in thinning work, considering correlations found with growth rates and ease of use in the field. Tables and charts are presented for converting between seven measures of stand density.

Conclusions about the influence of thinning on stand growth are:

(1) In pulpwood stands, the chief function of thinning is to prevent mortality loss. Yields over one rotation can be increased 20 to 35 per cent or more in merchantable volume thru careful thinning.

(2) Over a wide range of stand density gross growth is affected but little by thinning.

(3) A small reduction in gross growth, perhaps 10 per cent, may follow thinning for a few years. In stands where mortality loss is negligible, this small reduction after thinning may counterbalance any advantage in thinning.

(4) Reduction in gross growth at very high densities was not found.

The dial gauge micro-dendrometer was used in the field experiments.

The economic opportunity for more intensive management of pulpwood stands thru thinning is indicated by transportation costs of \$6 to \$8 and as high as \$15 per cord being paid by Lake States pulpwood-using industries. Logging costs appear to increase \$2 to a maximum of \$4 per cord in thinning operations. Therefore, where stands of a size and density for thinning exist near pulpwood markets, less costly pulpwood can be obtained thru thinning than some that is now being used. Minimum pulpwood cost to any user would result from equating the marginal cost in distant clear-cut stands and nearby thinned stands. An approximate method for equating these margins is suggested.

A survey of pulpwood users in Minnesota and Wisconsin indicated that during the years 1951 and 1952 there was a general interest in thinning, that some thinning for pulpwood was being done, and that there was and will be greater opportunity for use of thinning. The limiting factors were, first, a deficiency of stands of sufficient size and density for thinning, and, second, some failure to recognize where economic opportunity for thinning exists.

The suggestion is made that more extensive use of thinning can give pulpwood costs greater flexibility in the face of variable economic conditions. Also suggested is more attention to zonation of forest ownerships for variation intensity of management.

293 pages. \$3.66. MicA54-2776

THE DESIGN AND CONSTRUCTION OF A WOOD CHIPPING UNIT AND THE DETERMINATION OF COSTS OF PRODUCING WOOD CHIPS FROM FARM WOODLOTS; WITH IMPLICATIONS FOR FORESTRY EDUCATION IN AGRICULTURE

(Publication No. 9758)

Overton Rexford Johnson, Ph. D.
Cornell University, 1954

This study was conducted in an effort to discover some of the answers to the problems involved in the production of wood chips for agricultural purposes. Specifically, the purposes were: (1) to design and construct a wood chipping unit using a C-9 Fitchburg chipper and a U-9 I.H.C. power unit which could be adapted for use in small woodlot holdings; (2) to determine the relative costs of producing and handling wood chips from different types of forest growth; and (3) to discover the forestry educational problems involved in the utilization of wood chips and the implications for forestry education in agriculture.

The data for this study were obtained from the repeated designing and constructing, and field trials of the experimental unit during the production of 31.2 tons of wood chips. The productive capacity of the unit was determined by use of dimension stock and an absorption dynamometer. A limited merit comparison of wood chips and wood shavings as a bedding material was made using thirty yearling heifers over a five-week period.

The chipping unit was designed for efficient and practical use in farm woodlots. Design improvements which were made included the installation of a blower, increasing the size and type of feed plate spring bolts, and the construction of a device for adjusting belt tension.

It was found that the power unit could develop only forty-four horsepower although it was rated at fifty-five by the manufacturer. The maximum capacity of the unit, forty-four horsepower, was required to chip two square inches of oak and four square inches of pine wood at one-fourth inch knife setting, and six square inches of oak and ten square inches of pine wood at one-eighth inch knife setting.

The cost of producing wood chips was determined by using six different types of forest growth - plantation thinnings, shade tree tops, brush and prunings, logging waste, and sprout growth. Twelve species of wood were used. From the different types of forest growth, 61,056 pounds, or 31.2 tons of chips were produced within a total elapsed time of eighteen hours. The total production rate attained was 1.7 tons per hour. The total productive time was 14.7 hours, or 81.4 percent, and the nonproductive time was 3.3 hours, or 18.6 percent.

A total of 4.3 man-hours per ton was required for the total production of chips. It cost \$5.85 per ton to prepare and deliver the wood to the chipper as compared to \$2.65 per ton to chip the wood. There was a total cost of \$265.20, or \$8.50 per ton.

It was concluded that chipping units, at present, are too expensive to be owned by the average farmer or woodlot owner. However, it is quite feasible that

chippers could be owned and made available to farmers and woodlot owners through custom operators, cooperatives, or on a community basis by Soil Conservation districts. The portable wood chipper is still in the experimental stage. However, the prospects for solution are very bright, but a great deal must be done to increase the effective use of chippers. This calls for further improvements of design and operation.

It was found that the largest expense involved in the production of wood chips is the preparation of materials. Materials common to the woodlots of New York State can be prepared and chipped as an agricultural product much cheaper, in many counties, than the current purchase price of wood shavings or straw. This chipped wood product also is a very good substitute bedding material and has inherent agronomic values.

The general acceptance of woodchips in agriculture would further the ideal of woodlot management; selecting for market that which is merchantable and utilizing the tops, branches, cull trees, and weed species for chips for the farm. This ideal can be realized through the joint efforts of research and education.

176 pages. \$2.20. MicA54-2777

AGRICULTURE, PLANT CULTURE

AN EQUATION DESCRIBING THE AIR COOLING OF LETTUCE HEADS

(Publication No. 9742)

James Arnold Cook, Ph. D.
Cornell University, 1954

Data was obtained experimentally and used to formulate an equation describing the temperature changes of lettuce heads during cooling.

Heads of lettuce were cooled in cold air moving at speeds between 10 and 705 feet per minute. Temperatures at the center of the heads were measured with thermistors. The rate of cooling was not greatly affected by changes in airspeed, except when the change was a reduction to, or an increase from, 10 feet per minute. The second lowest airspeed tested, 40 feet per minute, and all higher airspeeds, cooled much more rapidly than did the 10 feet per minute rate. The weight of the head had no clearly defined effect on the rate of cooling and, within the normal range of variation, was not of practical importance.

The equation $Y = M - AR^x$, which was used by Spillman in 1933, was found not to be completely satisfactory for describing the cooling of lettuce. A correction factor was devised to change the portion of the calculated curve where the error was greatest. The factor was a fraction which decreased in magnitude after the start of cooling and rapidly became insignificant. This fraction was subtracted from the

calculated value to give the corrected figure. The factor was found to give a satisfactory corrected curve in 18 trials.

The equation with the correction factor is of limited use, since the first point of inflection of the observed curve must fall within a restricted range of time values. This range has not been completely delimited.

74 pages. \$1.00. MicA54-2778

HYPERSENSITIVITY OF SOLANUM TUBEROSUM L. HYBRIDS TO POTATO VIRUS Y (MARMOR UPSILON HOLMES)

(Publication No. 9743)

Merwin Kenneth Corbett, Ph. D.
Cornell University, 1954

Inbred lines of potatoes were mechanically inoculated in the greenhouse with four strains of virus Y. Those clones that gave no reaction and those that produced local lesions without systemic infection were planted in exposure plots in the field. Almost all became systemically infected. Virus obtained from some of these was used in the greenhouse for mechanical inoculation of healthy plants of one of the clones that appeared to be hypersensitive in the original tests. Local lesions resulted with no systemic infection. This reversal in reaction from apparent hypersensitivity to systemic infection was found attributable to a difference in the method of inoculation. Clones that appeared to be hypersensitive or nonreactors to mechanical inoculation became systemically infected when inoculated in the greenhouse by means of aphids that were allowed to seek their own feeding site. Systemic infection also developed when virus was introduced into plants of these clones by graft, by aphids on very young plants, by mechanical inoculation of very young leaves of older plants or by mechanical inoculation of very young plants. Inoculation of older leaves, either mechanically or by means of aphids, resulted in localization and not in systemic infection. Application of indole acetic acid in lanolin to the petioles of inoculated leaves did not affect local lesion formation, but delayed leaf abscission. Systemic infection occurred in these plants, but not in comparable non-treated ones. The results show that the clones studied are not truly hypersensitive but rather that localization of virus following mechanical inoculation of older leaves in these clones is the result of slow movement from the site of inoculation coupled with abscission of the inoculated leaves.

52 pages. \$1.00. MicA54-2779

A STUDY OF SOME RESPONSES OF
FLORIDA CITRUS TREES TO
NITROGEN NUTRITION AND IRRIGATION

(Publication No. 9707)

Ahmed Mohamed Labib El-Tomi, Ph. D.
University of Florida, 1954

Satsuma leaves are more numerous per shoot and heavier individually than Hamlin leaves. They also run higher in nitrogen and in chlorophyll contents than Hamlins. The dry weight of satsuma leaves constitutes a larger percentage of their fresh weight, and the fresh weight per unit area is greater, than in Hamlin leaves.

The response of the two varieties to differential applications of nitrogen to the soil were quite similar as judged by the fresh and dry weights of the leaves on an average shoot, by the chlorophyll content of the leaves (weight per unit area), and by the total and the percentage content of nitrogen in leaves. Significant differences were observed in the satsumas alone as indicated by the dry weight per leaf, and the weight of leaves as percentage of fresh weight; and only in Hamlins did the number of leaves per shoot correlate with soil nitrogen applications.

When the responses of these species to three levels of soil nitrogen were analyzed, it was found that when any significant differences were observed in the leaf characters studied, the high nitrogen plots always gave higher values than the low nitrogen ones. Usually there was no significant difference between responses of the high and medium nitrogen plots.

The leaves of the spring flush only were studied, and monthly analyses made from March, when they first appeared, until February, just prior to the next spring flush. For both Hamlins and satsumas the values for dry weight and nitrogen in an average leaf, and of dry weight as percentage of fresh weight of the leaf, were lowest in the young new leaves of March and increased to a maximum at the end of the period in February. The values of fresh and dry weights of the leaves on a single twig, and of the nitrogen in such a leaf sample, showed a similar seasonal trend for satsumas; but in the Hamlins these items did not follow any definite seasonal pattern.

The leaf nitrogen of satsumas as percentage of dry weight of the leaf had a seasonal curve just the reverse of that for nitrogen on an absolute basis, being highest in March and lowest the next February. The fresh weight of a given area of satsuma leaf was least in the young March leaves, but reached maximum value in November and declined thereafter somewhat. The seasonal trend of these items was not consistent in the Hamlins.

The chlorophyll content of satsuma leaves, determined as weight per unit area, was lowest in the young leaves of March, increased to a maximum in autumn, and decreased again to a second minimum in February. In Hamlin leaves the chlorophyll also had a midseason maximum, a couple of months earlier than in satsumas, and decreased somewhat thereafter, but there was neither the very low value

shown by satsumas at the beginning of the season, nor as low as endseason value in February.

Maintaining some plots near the field capacity for water at all times by irrigation failed to give values for the measured quantities which were significantly different from those of the unirrigated control plots in most cases. Exceptions were the measurements of fresh weight per unit area in the high nitrogen plots, and of chlorophyll content in the low and medium nitrogen plots, both in the case of satsuma leaves only.

159 pages. \$1.99. MicA54-2780

STUDIES IN THE ESTABLISHMENT AND
MANAGEMENT OF LADINO CLOVER IN MISSOURI

(Publication No. 9177)

Oscar Hale Fletchall, Ph. D.
University of Missouri, 1954

Ladino clover, *Trifolium repens* L. var. Ladino, has shown promise as a legume to grow with grass for pasture. It was considered as a crop to fill the need for an easily established, long-lived legume.

Bromegrass, *Bromus inermis* Leyss, and tall fescue, *Festuca elatior* L., under different clipping treatments and in different densities of stand, were compared in greenhouse pots as associated grasses with ladino clover. The effects of clipping, and of temperature, on the growth of ladino clover seedlings alone and with tall fescue were studied in thermoregulated growth chambers in the greenhouse. Field studies included (a) seed sources, (b) rates of seeding, (c) rate of seedling development, (d) establishment in grass sods, (e) winter killing, (f) longevity, and (g) production.

In greenhouse pots, bromegrass was a stronger competitor with ladino clover than tall fescue. Bromegrass made much more root growth than tall fescue.

Eighty degrees Fahrenheit was more favorable than cooler temperatures for ladino clover and tall fescue herbage growth. Sixty-five degrees and eighty degrees were about equally better than fifty degrees for ladino clover root growth. Sixty-five degrees Fahrenheit was more favorable than fifty degrees or eighty degrees for tall fescue root growth.

Italian imported ladino clover seed was equal or superior to the certified domestic seed tested from the standpoint of type purity but uncertified commercial seed was not consistently pure as to type.

The botanical composition of the sward was affected for at least two years by varying the proportion of grass seed to ladino clover seed in the seed mixture, but experiments of longer duration indicated a tendency for thick stands of associated ladino clover to become thinner and for thin stands to become thicker.

Ladino clover seedlings were about average among those of other common legume crops in rate of growth in Kentucky bluegrass, *Poa pratensis* L., sod. Disking

the sod increased the rate of seedling growth, and preparing a normal seedbed increased the growth more than disking. Ladino seedlings grew most rapidly in association with bromegrass and slowest with bluegrass and with tall fescue.

Good stands of ladino clover were obtained in dense sods of each of five grasses. Disking to kill about half the grass was helpful, but it was not always essential for successful establishment. Spring seedlings produced better initial stands than late summer seedlings in sods. Late summer seedlings were better for establishment on prepared seedbeds. Clipping in the spring of the year of establishment was helpful in getting stands of ladino clover in grass sods. Clipping for weed control was essential for success of spring seedlings on prepared seedbeds.

In a late summer planting of grass-ladino clover, the clover seedlings which grew in the row of associated grass heaved out of the ground much less than those which grew between the rows. Management to provide good vegetative cover in the winter almost eliminated heaving damage to ladino seedlings and to established ladino clover.

Ladino clover was maintained seven years in red-top, *Agrostis alba* L., in orchard grass, *Dactylis glomerata* L., in bromegrass and in Kentucky bluegrass. Although it grew little when soil moisture was low, it recovered after periods of moderate drought. Frequent periods of dry weather had a cumulative weakening effect. In a very dry growing season, ladino clover virtually disappeared from grass sods.

The application of good management and the addition of ladino clover to each of the common grasses increased the productivity and improved the stands of the swards. Grass-ladino clover mixtures gave a less uniform seasonal production than pure grass stands.

173 pages. \$2.16. MicA54-2781

THE ABSORPTION AND TRANSLOCATION OF RADIOSTRONTIUM BY THE LEAVES, FRUITS AND ROOTS OF CERTAIN VEGETABLE PLANTS

(Publication No. 9951)

Dudley Carl Martin, Ph. D.
Michigan State College, 1954

The relatively large amount of strontium present in the products of uranium fission has stimulated new interest in the qualitative and quantitative aspects of strontium absorption and translocation by plants. From the standpoint of radioactive contamination of crop plants, the absorption by leaves and fruits becomes at least equal in importance to root absorption. In this investigation tomato, beet and bean plants were used in sand culture to study both root and foliage absorption of radiostrontium, radiocalcium and radiobarium. Both the spectrograph and the flame spectrophotometer were used to quantitatively analyze plant tissues for strontium, calcium, potassium, magnesium, phosphorus, boron, iron, manganese and

copper. Autoradiography and radioactive sample counting were the important isotope techniques employed.

Strontium applied to the roots of tomato, beet and bean plants was absorbed by the roots and translocated to all above ground plant parts. Generally its absorption was proportional to its concentration in the nutrient solution, and also to its concentration relative to calcium, providing the treatment period was long enough for equilibrium to occur. Strontium can accumulate in tomato and beet tissues in amounts almost equivalent to the normal calcium content, but at such high concentrations it is toxic to both plants. Beets can accumulate higher strontium concentrations in the plant tops and are less sensitive to strontium toxicity. Strontium and calcium in the same nutrient solution mutually favor the absorption of each other as compared to the same amount of strontium or calcium alone. The effect of high strontium and low calcium content of plant tissues upon the absorption of other nutrients is discussed.

Autoradiographic studies indicated that radio-calcium, radiostrontium and radiobarium are absorbed by tomato and beet roots and translocated to all above ground plant parts. The upward translocation of strontium is greater than that of barium but both elements tend to accumulate in the vascular tissues. Tomato fruits accumulate relatively little strontium, probably because of the low calcium requirement.

Tomato plants high in calcium always absorbed more strontium from a root application than those low in calcium when the applied strontium was in ionic form. However when the applied strontium was chelated, absorption was greater in tomato plants low in calcium. Plant calcium content had little effect on strontium absorption by beets.

In contrast to the free movement upwards and high accumulation of strontium from a root application, the movement of strontium from the site of a foliage or fruit application was very slight or completely lacking. Bean and beet plants showed a somewhat greater downward movement than tomato plants but in neither was the amount translocated more than a trace of that applied. This was likewise true of calcium and barium. Chelation of strontium did not increase translocation away from treated tomato leaves or fruits. By means of autoradiography it was demonstrated that radiostrontium can penetrate the intact skin of a tomato fruit and accumulate in the inner tissues.

162 pages. \$2.03. MicA54-2782

THE USE OF THE FRUIT FLY, *DROSOPHILA*
MELANOGASTER, AS A BIOASSAY IN
 DETECTING MINUTE QUANTITIES OF BENZENE
 HEXACHLORIDE IN PLANT TISSUE

(Publication No. 9767)

Robert Edward Olson, Ph. D.
 Cornell University, 1954

The fruit fly, *Drosophila melanogaster*, was chosen as a logical bioassay test animal to determine the toxicity of organic chloride material found in potatoes raised on soil treated with Benzene Hexachloride. A uniform long-time inbred stock of the wild red-eyed variety was chosen.

The flies were raised in massed cultures in cotton-plugged, half-pint milk bottles, on a standard medium, under relatively sterile conditions and without mold preventive. Flies were transferred and counted by the use of light and gravity effects and a "transfer bottle" which permitted rapid counting of exact numbers with ease and without abnormal treatment.

All flies were raised under controlled conditions. New cultures were started and old ones eliminated daily. All new flies were collected daily, mixed, and a sample used for egg-laying in the new bottles for three days and as test animals on the fourth day. Cultures were used for only one generation.

All operations were necessarily carried on in a room with controlled temperature and humidity.

A set of twenty pure gamma BHC solutions from 10,000 P.P.M. to .01 P.P.M. were used in making the tests. Ether was used as the solvent because of its volatility but its tendency to produce peroxides on standing required frequent remixing of solutions.

The bottom two inches of the large pyrex test tubes used as treatment tubes were treated with an even residue of BHC or tuber extract by rolling the tube containing 1 cc of ether solution while holding it nearly horizontal. Traces of ether were eliminated by vacuum aeration for twenty seconds. Then twenty flies were introduced and confined to the treated surface by a tinfoil coated cotton plug.

The time till knockdown was used as the indication of toxicity. The 50% knockdown time determined by averaging the 25% point (5 down) and the 75% point (5 up) is the most accurate, easy to count and eliminates the critical problem of sex ratio.

The basic knockdown curve (pure BHC) showed little change in time till knockdown between 10,000 P.P.M. (2.3 min.) and 10 P.P.M. (3.6 min.) and the curve was between 10 and .4 P.P.M. (41.3 min.).

The BHC had more rapid toxic action on small than on large flies and on males (small) than on females. Newly emerged flies (2 days) were very sensitive. Then for several days the flies showed maximum hardness. Finally as the flies grew older they gradually grew sensitive again. Thus four-day-old flies were used. Both temperature and humidity appeared to be factors of utmost importance in speed of knockdown and fluorescent light must be used exclusively because of the temperature effect of incandescent light in closed tubes. Aeration and time be-

tween treatment and fly introduction should be kept to the minimum.

The toxicant was extracted from the tubers by a triple steam-distillation process. One kilo of tubers gave 100 cc of ether extract. Preliminary results indicated a partial breakdown of BHC by the process.

Tests on stored tubers from several experiments indicated toxic materials present in tubers from BHC treatments. The results were reproducible in replicates and indicated that a curve could be constructed by using different quantities of extract evaporated to 1 cc to treat the tubes.

Tests on check tuber extracts free of toxic action with known quantities of BHC added, showed that BHC could be readily detected if actually present, and gave similar results to pure BHC solutions. In high concentrations, however, the knockdown was slower but the extract appeared to prevent vaporization and knockdown was reached in extracts as dilute as .1 P.P.M. (61.5 min.). Thus fortunately a flatter, longer and more sensitive curve was secured. The technique would thus appear to hold promise as a bioassay.

141 pages. \$1.76. MicA54-2783

YIELDS OF POTATOES AS INFLUENCED BY
 APPLICATIONS OF PEAT AND MANURE
 TO A SANDY LOAM SOIL

(Publication No. 10,040)

Roger France Sandsted, Ph. D.
 University of Minnesota, 1954

Eighteen annual applications of manure, peat and inorganic fertilizers were made to a sandy loam soil. The effects of these treatments on yields of potatoes and on certain chemical and physical properties of the soil were studied.

Higher total and marketable yields resulted from plots which received a complete (NPK) fertilizer than from plots which received peat supplemented with phosphoric acid and potash or from plots which received manure only.

Annual applications of peat at 20 tons per acre supplemented with phosphoric acid and potash resulted in higher organic matter content, higher total nitrogen content, and higher moisture equivalent of the soil than did annual applications of 20 tons of farmyard manure only. Manure applications only, resulted in higher organic matter content, higher total nitrogen content, and higher moisture equivalent of the soil than did applications of a complete (NPK) inorganic fertilizer.

Manure and peat applications resulted in slightly increased pH of the soil while inorganic fertilizers resulted in decreased soil pH.

Tests for available phosphorus and potassium indicated that the manure- and peat-treated plots had a slightly higher content of these nutrients than did the inorganically fertilized plots.

Leaf petiole tests for soluble nitrogen and phosphorus indicated that the inorganically treated plots

furnished a more readily available supply of nitrogen to the plants than did manure- or peat-treated plots. These inorganically fertilized plots produced the highest total and marketable yields of potatoes.

Correlation coefficients obtained between growing season temperatures and total yields, and between rainfall and total yields tended to substantiate the evidence that the nitrogen in the manure- and peat-treated plots was not as readily available for plant growth as the inorganic nitrogen in the inorganically fertilized plots.

71 pages. \$1.00. MicA54-2784

THE EFFECT OF NUTRITION ON THE
SUSCEPTIBILITY OF TOMATO,
LYCOPERSICON ESCULENTUM MILL., TO
THE EARLY BLIGHT FUNGUS,
ALTERNARIA SOLANI (ELL. AND MART.)
JONES AND GROUT

(Publication No. 9799)

Lewis Allen Schafer, Ph. D.
Cornell University, 1954

Bonny Best tomato seedlings were grown in various nutrient solutions in sand culture and with different fertilizer treatments in soil. The plants were inoculated with *Alternaria solani* to determine the effect of nutrition on the susceptibility of tomato plants to this fungus.

Tomato seedlings were grown in 15 different nutrient solutions in sand culture. When the seedlings were three weeks old they were inoculated with spores of the fungus. Infection records were taken 36 hours later.

The minus phosphorus treatment resulted in the highest percent infection. In each case infection was significantly higher with plants grown in the minus phosphorus solution than with plants grown in the balanced nutrient solution serving as the control. The seedlings grown in a nutrient solution with a nitrogen deficiency had the least infection. The amount of infection in the different treatments was not found to be correlated with the size of the tomato seedlings.

Results obtained by growing tomato seedlings with 14 different fertilizer treatments in soil were similar to those obtained from the sand cultures. Procedures for obtaining infection with the tomato seedlings were the same for the plants grown in soil as for those grown in sand culture. The combination of nutrients which resulted in a moderate to high amount of nitrogen, a deficiency of phosphorus and a low to high amount of potassium increased the percent infection. Plants grown under conditions of nitrogen deficiency, regardless of the phosphorus and potassium content, had a low percent infection. There appeared to be a definite relationship between nitrogen and phosphorus regarding susceptibility of tomato to *Alternaria solani*. Although the mechanism of this relationship is not known, hypotheses based

on data presented in this paper are suggested which may account for this action.

When the fungus was cultured in nutrient solutions, growth was greatest when the three major elements (nitrogen, phosphorus, and potassium) were present in a normal or excessive amount. There was a decided decrease in growth in all cases when the major elements were deficient. Growth of the fungus in the solution containing the three major elements in normal amount, but deficient in the minor elements (supplementary solution), was similar to the growth in those solutions in which the major elements were in moderate to high amount with the minor elements present.

Differences in growth of *Alternaria solani* were observed when the fungus was cultured in extract from tomato seedlings grown in various nutrient solutions. The amount of fungus growth could not be correlated with either the amount of growth produced by the tomato plants grown in the nutrient solutions, or the amount of infection by *A. solani* on the tomato seedlings grown with the various nutrient treatments.

77 pages. \$1.00. MicA54-2785

THE USE OF FUNGICIDES IN THE
PRESERVATION OF MOIST HAY AND GRAIN

(Publication No. 9776)

Roy Urban Schenk, Ph. D.
Cornell University, 1954

Field drying of grain and especially hay is often difficult or even impossible due to inclement weather conditions. Ensiling of forage diminishes this problem, but involves the cost of constructing silos. Dry matter losses in storage are also quite high. Artificial drying of moist hay or grain reduces the weather hazard, but the equipment and operation costs are deterrents.

When moist hay or grain is stored, molding and the resulting heating cause deterioration. This suggests that moist hay and grain could be preserved if mold growth were controlled by an effective fungicide.

The present work was devoted to studying the problems inherent in the fungicidal preservation of hay and of grain for seed and for animal consumption. The chemical, 2,4,6-trichlorophenol, was used to preserve the feedstuffs because in these and earlier studies it gave the greatest fungal control per dollar of cost. Further work was devoted to testing the preservative properties of over 70 new chemicals in the laboratory. A few of the most promising compounds were further tested in the field.

A wide variety of chemicals were effective in these laboratory studies. Two groups of chemicals which showed considerable promise were a series of halogenated aliphatic carbonyls, especially ketones; and a series of halogenated phenols plus salicylaldehyde and its chlorinated derivatives. The carbonyls were not tested in the field, but laboratory results suggest that their effectiveness may be limited by

their volatility. After preliminary laboratory studies, benzyl chloride, o-dichlorobenzene, sodium metabisulfite, trichlorophenol, and a mixture of methyl ethers of propylene and polypropylene glycols were tested in the field on hay and grain. The only compound which gave satisfactory results was 2,4,6-trichlorophenol.

The field studies with trichlorophenol showed that it is very difficult to obtain an adequate distribution of a fungicide on hay. The most satisfactory method of application of a fungicide is dependent on the properties of the material being applied, but it seemed that application just prior to raking was most satisfactory for a liquid material.

When trichlorophenol was applied to moist hay in the field, the rate of drying of the hay during storage was drastically reduced. The dry matter losses were also decreased, but a slow rate of dry matter loss appeared to continue throughout a 33 week storage period.

Trichlorophenol treated hay was fed to cows and sheep. The fungicide treatment had little if any effect on digestibility or palatability of the hay. The trichlorophenol consumed was absorbed by the animals and detoxified mainly in the urine. The urine of the cows and sheep eating treated hay was very dark in color. The reason for the dark color was not found, but the urine was found to contain increased amounts of sugar and sulfur, no doubt due to the detoxication of the trichlorophenol as the glucuronate and ethereal sulfate.

Although most of the trichlorophenol excreted was in the urine, a trace of the chemical was present in the milk of cows. A small amount of the trichlorophenol was also present in the feces. However, the quantity of the chemical present in all of the excretory products was only about half as great as the amount consumed by the animals.

At the same time that studies were being conducted on moist hay, field samples of corn and oats were treated with trichlorophenol and several other fungicides. Mold growth was controlled by trichlorophenol treatment, but the grain developed a dark brownish color and an off odor and flavor. When the treated corn was fed to chickens, their feed consumption and weight gain were lowered somewhat.

Germination of the trichlorophenol treated grain was inhibited. Several other fungicides were tested to determine if they also inhibited germination. Only thiourea did not decrease germination, but it controlled mold growth for only a short time, and germination ultimately declined.

The results of these laboratory and field studies indicate that the use of fungicides for preservation of moist hay and grain for animal consumption is a definite possibility. At present it is limited by the lack of an effective fungicide which is also cheap enough and safe to use.

108 pages. \$1.35. MicA54-2786

THE EFFECT OF VARYING MINIMUM SOIL MOISTURE LEVEL ON GROWTH AND MINERAL ABSORPTION OF SOME YOUNG HORTICULTURAL CROPS

(Publication No. 7591)

Isaac Jack Wahba, Ph. D.
University of Missouri, 1954

A study was made of plant growth and mineral nutrition under various soil-moisture stresses within the readily-available moisture range because of several contradictory reports regarding the effect of soil-moisture supply upon such plant physiological processes as mineral uptake, respiration, transpiration and photosynthesis, which, in turn, affects crop yield and quality. The importance of regulating fertilizer applications according to the available soil-moisture supply has been pointed out.

It has been shown that soil moisture is equally available for transpiration throughout the range between field capacity and permanent wilting percentage but there is evidence to indicate that plant growth is promoted through an increase in soil-moisture supply within the readily-available range. Contradictory results have also been obtained regarding the effect of soil-moisture supply on the mineral element absorption and composition of plants.

Young plants of gladiolus from corms, onions from sets, and sweet corn and kale from seed, were grown for periods of four to twelve weeks in open moisture containers containing approximately 4000 grams of soil. Minimum soil moisture levels of 75%, 50%, 25% and 0% of the readily-available moisture range as determined by Bouyoucous gypsum blocks were maintained by bringing the soil moisture level back to field capacity with distilled water as soon as the minimum had been reached. The fresh weight, dry weight; and the calcium, magnesium, potassium and phosphorus content of the plant ash were determined at the end of the experiments. The supply of available Ca, Mg, K and P was varied from the very low levels in leached quartz-sand to the saturation level in a high exchange-capacity field soil.

The modifying factors of a reserve of nutrient supply (gladiolus corms and onion sets), plant density in relation to available nutrient supply and ratios between the levels of the four nutrients, were imposed at these moisture levels.

The total plant growth and dry-weight increases were greatest at the highest moisture levels regardless of the modifying factors imposed. This effect was intensified by lowering the level of available nutrients or increasing the plant stand relative to soil volume. The uptake of Ca, Mg, K and P per plant increased with soil moisture supply. The concentration of K and P in the plant tissue also increased. Increasing the supply of a single element or a combination of elements usually increased the total amount taken up by the plant but sometimes depressed the absorption of other elements. Increasing the total supply of plant nutrients tended to offset, to some extent, the unfavorable effects on growth of a decreasing soil moisture supply.

125 pages. \$1.56. MicA54-2787

ANATOMY

CYTOCHEMICAL LOCALIZATION OF CERTAIN PROTEINS BY FLUORESCENT ANTIBODY TECHNIQUES

(Publication No. 9606)

John Marvin Marshall, Jr., Ph. D.
University of Illinois,
Chicago Professional Colleges, 1954

Antibodies labelled with fluorescein were used in studies of distributions of specific proteins in cells and tissues. Attempts were made to localize ACTH in the pituitary and chymotrypsinogen, pro-carboxypeptidase, desoxyribonuclease, and ribonuclease in the pancreas. Fluorescent antibody solutions were also used as labelled proteins in a study of the uptake and intracellular digestion of protein by the amoeba, *Chaos chaos*.

The antibody localization method was examined critically by the use of fluorescence and phase contrast microscopy and by micro-fluorometric analysis. Artifacts of inadequate fixation were revealed, and improved techniques of fixation were devised. These were based on freeze-drying with post-fixation in cold methanol or in buffered dioxane-formaldehyde.

An antiserum to pig ACTH was produced in an adrenalectomized rabbit, and from it a fluorescent globulin solution was prepared. This solution stained selectively the cytoplasm of basophil cells in pig pituitary. The specificity of the reaction was established by control procedures employing other tissues and labelled normal serum globulin, and by quantitative precipitin tests of the labelled antibody with an active ACTH polypeptide.

Fluorescent antibodies for beef chymotrypsinogen and for beef carboxypeptidase stained only the zymogen granules of the acinar cells of beef pancreas, the clear cytoplasm around the granules in the apex of each cell, and the juice within the duct system. Control procedures were employed to establish the specificity and reliability of the results. It was concluded that, in the resting pancreas, both zymogen antigens occurred in the same sites, and neither occurred in detectable amounts in nuclei, in mitochondria, or in the basal cytoplasm of acinar cells.

Fluorescent antibodies for desoxyribonuclease and ribonuclease of beef pancreas stained the same structures in sections of beef pancreas as did antibodies for the two zymogens, but in addition stained the entire cytoplasm of certain acinar cells. The cells stained in this fashion by antibodies to DNAase were not the same as the cells stained by antibodies to RNAase. It was concluded that crystalline preparations of both depolymerases might be heterogeneous, and therefore the distributions of the individual antigens in each could not be determined. But in the

resting pancreas no DNAase or RNAase antigens occurred in detectable amounts in nuclei or in mitochondria.

The amoeba *Chaos chaos* was found to ingest droplets of labelled protein solutions under certain conditions. Observations on centrifuged, freeze-dried amoebae, and micro-fluorometric analyses of amoebae, revealed that individual cells took up about one-third their own volume of protein solution during three hours of feeding. The labelled material was eliminated in five to six days. It was concluded that the protein taken up by amoebae was digested intracellularly, and that fluorescein-labelled amino acids were not incorporated. The findings were related to other studies on digestion in *Chaos chaos* and to reports in the literature on pinocytosis and intracellular protein digestion in mammalian tissues.

81 pages. \$1.01. MicA54-2788

ENDOCRINE INTERRELATIONSHIPS IN THE GENESIS OF ADRENAL CORTICAL TUMORS IN INBRED MICE

(Publication No. 9607)

Harry Monsen, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1954

Estrogen secreting adrenal cortical adenomas develop regularly in gonadectomized male and female mice of the NH strain. Evidence for estrogen secretion is based upon the histological appearance of the reproductive tract in the female. Parabiologic union of a tumor-bearing animal with a young intact female mouse resulted in a hyperstimulated reproductive tract of the latter. During the parabiologic union, the vaginal smear of the tumorous animal changed from an estrous to a castrate type. It was suggested that the increased circulating amount of FSH in the castrated, tumor-bearing animal was diluted subsequent to the parabiologic union, and that the resulting lower level of circulating FSH in the tumor-bearing animal was incapable of eliciting estrogen from the adrenal adenomas, while the greater susceptibility of ovarian tissue to FSH resulted in an increased production of estrogen in the intact partner.

Union of tumor-bearing animals with castrated young females did not result in changes of the vaginal smears. The tumorous animals remained in constant estrous and the castrated females produced castrate smears.

When castrated animals, treated with estradiol dipropionate for 5 months from the time of castration,

were placed in parabiosis with young intact females, there were no hyperstimulation of the reproductive tract of the latter. The exogenous estrogen depressed the pituitary FSH production in the castrated parabiont.

Administration of testosterone propionate for 5 months to castrated female mice, starting immediately after castration, prevented the induction of adrenal cortical adenomas.

When androgen treatment was initiated 2 months after castration, adrenal tumors developed in 8 out of 9 mice, while all animals which received androgen 3 months post-castration developed adenomas. High doses of testosterone phenylacetate did not cause observable physiological or cytological alterations in established adrenal adenomas.

Regeneration of normal adrenal cortical cells was observed following enucleation of adenomatous adrenal glands. There was no proliferation of adenomatous cells from the adrenal capsule.

Ingestion by castrated mice of 0.4% propylthiouracil in the food for 7 months did not prevent the development of small adenomatous nodules in the adrenals, but the reproductive tract of the female mice were not hyperstimulated. The body weights of these animals were lower than those of controls,

due to anorexia, and it has been shown by other investigators that caloric restriction (in C3H mice) may prevent changes in the reproductive tract in animals bearing adrenal cortical adenomas.

Intraperitoneal administration of NaI^{131} to gonadectomized animals of both sexes did not prevent the appearance of physiologically active adrenal cortical adenomas in female mice. None of the male animals showed cytological evidence of adenomatous alterations. All experimental animals maintained normal body weights throughout the study.

One estrogen secreting adrenal carcinoma originating in a female mouse of the Ce strain which had been castrated for 12 months was transplanted to intact and gonadectomized males and females. Three months following castration, there were viable grafts in all castrated hosts, but no "takes" were observed in the intact animals.

Of 6 animals, gonadectomized 2 1/2 months subsequent to transplantation, all possessed viable grafts 2 1/2 months after gonadectomy. It was concluded that this tumor would only grow in a disturbed endocrine environment such as precipitated by the removal of the gonads.

81 pages. \$1.01. MicA54-2789

ANTHROPOLOGY

THE CAMARS OF SENAPUR: A STUDY OF THE CHANGING STATUS OF A DEPRESSED CASTE

(Publication No. 9741)

Bernard S. Cohn, Ph. D.
Cornell University, 1954

The objectives of this study are threefold: to provide ethnographic data on the structure and functioning of an untouchable caste within the framework of a North Indian Hindu village; to describe and analyze the attempts of an untouchable caste to raise its social and economic status in such a village; and to analyze the place of such a caste in a program of introduced change.

The group studied was the Jaisvara sub-caste of the Camars, and the village in which the study was carried out is located in Jaunpur District in the Eastern part of Uttar Pradesh (formerly the United Provinces). The study is based on one year of intensive anthropological field work in Jaunpur District.

The Camars, whose traditional caste occupation is skinning and tanning, primarily make their living in the village studied as agricultural workers with traditional contractual ties to the landlords of the village. The Camars live on a bare subsistence income, and in recent years with the continuing rise in population in the village and the increase in culti-

vation of land by the landlords, the Camars' economic position has steadily deteriorated.

Concomitant with the deterioration in economic position and general structural changes in the society, the Camars have been trying to raise their status. Behavior of the upper caste landlords is changing in the direction of an urban, cosmopolitan pattern, but the behavior of the Camars and other lower castes is changing to what the upper caste behavior was in the past. The Camars have given up many aspects of their behavior which are considered degrading and are taking over in their religious activities "Sanskritic" rituals.

The Camars along with other low castes have been active in organizing a local political party to contest village elections. Through winning the local elections they have taken over the formal power structure of the village, but the landlords still retain informal control. This confusion of control of formal and informal power and the presence of village factions make the introducing of new techniques for agriculture and other village improvements difficult.

Since the Camars are on such a low economic plane, a program of improvement might be of more benefit to the upper castes, who have some measure of security and can experiment, and who because they farm larger portions of the land would proportionally and absolutely gain more from improved techniques. Therefore, a program of change might widen the

already wide gap between rich and poor and high and low caste in the village.

326 pages. \$4.08. MicA54-2790

THE CONTRIBUTION OF ASSOCIATIONS TO
EVOLUTIONARY CHANGES IN CULTURE
IN FOUR AFRICAN SOCIETIES

(Publication No. 10,176)

Zachary Gussow, Ph. D.
Columbia University, 1954

This thesis analyzes the contribution of associations to evolutionary changes in culture in four African societies: Masai, Zulu, Nyakusa and Mende. The method of analysis is functional-historical and comparative.

The main hypothesis regarding the emergence and functions of associations is as follows: In primitive societies associations arise under conditions of a changing social system which gives rise to new roles, the allocation of which is not determined by membership in kinship groups, and where important integrative functions remain to be fulfilled beyond the scope of these groups.

The extent to which associations affect coexisting social and cultural institutions and patterns varies with the extent to which corporate kinship units are coordinated with the political and territorial structure and the division of labor is vested in the one and not the other.

Among the Masai changing conditions of existence created new roles which extended beyond the scope of the kinship units. There age associations are corporate entities, the chief functions of which are military, political and judicial. The age-sets which are composed of coevals from all the neighboring kraals, and not the kinship units, are coordinate with the territorial structure. Interaction of the descent units is regulated through the age-set system. In addition to the performance of specific tasks which are of importance to the entire society the age system, and not the descent groups complete the process of education and socialization. Age-set commitments continue to affect members throughout their lives.

Among the Nyakusa where permanent villages are formed of boys and men the territorial structure is coordinate with the age-villages. Military, political and juridical functions are coordinate with age-villages; roles being allocated by seniority. Due to the lesser importance of cattle in their lives the boys' villages are not autonomous, separate entities. The kinship unit as a corporate entity is broken into at an early date as youths at puberty retire to their own village and is never reestablished as brothers permanently live apart. Economic help, moral obligations, social relations, etc., are coordinated with age-village life and not with kinship.

Among the Zulus the transition from autonomous tribal units to a centralized chiefdom created new military roles which were fulfilled by coevals as-

sembled from among the local tribal areas. Political relations, although distinct from descent groups, yet depend upon representation from these groups. As there is a special locus of authority - the Chief - the autonomy of the age groups is relatively small; hence they do not constitute a self-regulating organization. Age groups are directed by the Chief and their activities are subordinate to the centers of political power. The extent to which they regulate the over-all behavior of their members and determine their status is thus limited. As members come from different tribal areas there is little possibility for the continuation of corporate activity after military service is terminated. To a limited extent, however, bonds of friendship and mutual help persist throughout the lives of members.

Among the Mende many new roles were created under the changing conditions of existence. These roles extended beyond the scope of the tribal structure based on descent. Social status was determined more by wealth than by position in the descent group. The special achieved-based association (Poro) which developed provided a way of translating wealth into political authority. Control of the tribal institutions passed from the hands of the local tribal chiefs to the leaders of Poro. The greatest strength and authority of Poro lay in its regulation of inter-community affairs for which the traditional tribal structure had not corresponding mechanisms for regulating. With the passing of controls from the local descent groups to Poro many integrative functions - educational, vocational, etc., came under their supervision. The uniting of isolated and scattered communities into a network of economic relations were backed up by political, military and supernatural authority, the regulation and allocation of positions of which were controlled by the leaders of the Poro.

145 pages. \$1.81. MicA54-2791

INSTITUTIONAL PARTICIPATION OF WOMEN
IN A CALIFORNIA TOWN IN THE STRUCTURES
OF ECONOMIC ALLOCATION, OF INTEGRATION,
AND OF EXPRESSION

(Publication No. 10,078)

Eileen Pease Kuhns, Ph. D.
Syracuse University, 1954

Adviser: William C. Lehmann

This dissertation may be regarded as a structural-functional analysis of a particular partial social system. The theoretical materials in the main have been drawn from the works of Talcott Parsons, Marion J. Levy, Robert Merton, and Ralph Linton.

We have attempted to fill in parts of the structural-functional "picture" of an agricultural town by relating the effects of certain status-roles on community participation; i.e., on the assumption of other status-roles.

The materials and tools of the social scientist

make it difficult for him to consider simultaneously an indefinite number of variables. It is just this dilemma that the structural-functional approach attempts to mediate. Thus, in this study, by using this approach we have been able, as it were, to "immobilize" community life while we examine, one after another, forty relationships involving independent and dependent variables, each of which has been studied with respect to a minimum of eight distinct population groups.

The hypothesis set forth in this thesis has been that certain status-roles affect the assumption of, or degree of participation in, other specific status-roles. Thus both our independent, and our dependent variables have been specific status-roles.

Our independent variables were pointed out to us by the inhabitants of the area we chose to study, and included such factors as length of residence, place of residence, nationality group, and race.

Our dependent variables were chosen by the use of two criteria: (1) they must be status-roles involved in the institutional participation of women; (2) they must be status-roles which in minimal form are structurally and functionally requisite to the continued existence of any human society. By a combination of these two criteria, we arrived at the choice of status-roles involved in the structures of (1) economic allocation, (2) integration, and (3) expression.

Thus our hypothesis has been that status-roles based on length of residence, place of residence, nationality group, and race affect participation in the institutions making up the structures of economic allocation, integration, and expression.

Status-roles based on length of residence in the community included those of Oldtimer, Newcomer, and Migrant worker. Those based on place of residence were Rancher, and town resident. Status-roles involving race included those of White, Chinese, Japanese, Filipino, and Indian. Only one nationality group of any numerical consequence, the Italian, was to be found in the area studied.

With regard to the structure of economic allocation, this dissertation deals with consumption patterns, and with both agricultural and non-agricultural occupations.

The structure of integration includes the participation of women in the institutions concerned with education, religion, medical and hospital services, and social welfare programs.

The structure of expression is concerned with the participation of women in artistic, recreational, and club institutions.

From the final summaries, it appears that the four independent variables were of general predictive significance, with regard to various types of community participation, in the following decreasing rank order: race, length of residence, place of residence, and nationality group. With all of these, however, we must raise the question as to what extent these variables actually represent another independent variable, such as economic status. In order to answer this question, it would be necessary to set up a new hypothesis at the next level of abstraction,

which Goode and Hatt term "the relation of analytic variables." This in turn would require more refined research techniques than the non-directive procedures employed here, although such procedures were of definite value in (1) establishing empirical uniformities, and in (2) laying the basis for hypotheses concerning the relation of analytic variables.

265 pages. \$3.31. MicA54-2792

**RACIAL BLOOD PRESSURE STUDIES:
A CRITIQUE OF METHODOLOGY, WITH
ESPECIAL REFERENCE TO THE EFFECT OF
AGE, NUTRITION, CLIMATE, AND RACE ON
BLOOD PRESSURE IN PUERTO RICO**

(Publication No. 10,181)

Rupert Ivan Murrill, Ph. D.
Columbia University, 1954

At the beginning of this study the basic problem is stated as follows: - are there actual racial differences in blood pressure, or are the observed differences due to lack of control of such variables as age, urban or rural life, nutrition, climate or intestinal parasitic infestation? This study is divided into four parts.

In Part I, using a Puerto Rican sample, it is shown that in any blood pressure study the basic step is to obtain a representative sample. Having obtained such a sample then one has to analyse the blood pressure results particularly in regard to such variables as sex, age and weight groups. In addition such possibly important variables as urban or rural life, nutritional class, climate and intestinal parasitic infestation should not be over-looked.

Part II deals with the types of existent racial blood pressure studies; with general examples of the poor methodology to be found in such studies; and in conclusion a methodology is proposed for determining the possible existence of racial blood pressure differences. The latter methodology indicates that in racial blood pressure studies one must observe the following:-

1. The samples used must be representative of the racial groups in question.
2. Some proof must be given of the relative homogeneity of each racial group.
3. Each racial group should be equated on the basis of a number of variables, the most important of which are probably weight groups and age.

In Part III, following the methodology proposed in Part II, two Puerto Rican male racial samples, negro and white, are compared for any possible blood pressure differences. The results of this comparison show that, in regard to these specific negro and white samples, neither the systolic nor diastolic blood pressures are significantly different.

Part IV consists of a general summary and the conclusions of Part I - III as stated above, with a final admonition that valid conclusions regarding the effect of race on blood pressure can only be drawn from investigations that are properly controlled and analysed by critical methods. 142 pages. \$1.78. MicA54-2793

SEX DIFFERENTIAL IN MEMORY RETENTION OF ABORIGINAL BEHAVIOR PATTERNS

(Publication No. 10,012)

David Lagrove Scruton, Ph. D.
University of Washington, 1954

The thesis of this dissertation is that in a situation of contact between two cultures resulting in acculturation, women are characterized by a tendency to be the conservators of aboriginal behavior patterns, in contrast to men, who more quickly adapt themselves to the ways of the intrusive culture. The hypothesis is tested in terms of Indians living on the Muckleshoot Reservation, near Auburn, Washington.

The method used in the study is based on the assumption that such conservation can be observed not only in overt behavior, but also in the degree of memory-retention of aboriginal traits. An open-ended questionnaire was constructed and administered to Indians over 50 years of age. The questionnaire was designed to elicit information about certain major categories of aboriginal behavior, so that the degree of each informant's retention of Indian habits might be ascertained. Responses were recorded by means of a 7-point scale, the points ranging from 0 to 6. Higher scores were given for more complete replies.

The responses received from 10 men and seven women were treated in a variety of ways to determine whether or not there was a real difference between the memories of men and women. These included comparison of mean scores for the questionnaire as a whole, for its component sections, and for individual questions. Comparison was also made of the proportions of high and low scores from each sex group. The conclusion drawn from these manipulations is that there does exist an important difference between men and women, with women evidencing generally more complete memory of the past than men.

Various possible explanations of the phenomenon are considered, and the conclusion is drawn that the sexual division of labor is largely responsible, for it results in greater exposure of men than women to non-Indian behavior patterns, with a consequently more rapid rate of acculturation for men.

The dissertation is oriented primarily towards methodological problems. Apart from a consideration of the hypothesis, as such, it is concerned with the use of statistical techniques in research in cultural anthropology, the writer's contention being that all useful and pertinent methodological techniques should be employed in anthropological research, in order to give better foundation to generalizations.

138 pages. \$1.73. MicA54-2794

THE ROLE OF WOMEN IN A CHANGING NAVAHO SOCIETY

(Publication No. 9779)

Laila Sayid Shukry, Ph. D.
Cornell University, 1954

The thesis of this paper is that under the impact of recent social and economic changes, the role of Navaho women has been redefined in a generally adverse manner.

During the few decades following the 1868 resettlement of the Navaho reservation, the people managed to insulate themselves physically and psychologically against the impingements of the outer "white" world. Their way of life was geared to their own human and economic resources and, at the same time, was adjusted to limited interaction with the larger society. They lived in scattered matrilineal matrilocal extended family groups, and made their living by subsistence farming and livestock. Through the trading post, they bartered some of their products - lambs, wool and rugs - for the few needs with which the American industrial economy could supply them. In this traditional organization, the women played a prominent role. They were economically independent through ownership of livestock, and they were socially secure in their matrilocal residences. The woman and her children were the stable core of the family; and the home, in which she was the central figure, was the basic production and consumption unit, as well as the training ground for the younger generation.

A steady and rapid destruction of the Navaho land base through drought and erosion; government attempts in the 1930's to meet the situation through livestock reduction programs and the development of new economic resources (intensive irrigation farming, industrial development, and off-reservation employment); expanded government programs in the fields of education, health and public works; and the advent of World War II were all forces which pushed the Navahos into closer contact with and greater dependence on the outside world. In order to cope more adequately with life's new demands, they could no longer protect their cultural integrity, and they responded to the exigencies of the situation with crucial internal readjustments.

The Fruitland Irrigation Project, in which the field study was made, is a subsistence farming settlement that was initiated by the government in 1933. The economic and social organization that evolved in Fruitland has the following general features: People live on 10-20 acre plots in predominantly patrilocal residences - both extended and independent. Off-reservation employment is the most important source of income, supplemented by subsistence farming. Only a few own livestock. Men are the economic providers and the prime determiners of the status and standard of living of the family. Few women have independent sources of income. They depend on the wage-earners (the men), whose irresponsible spending (on cars and liquor, especially) are subject of much complaint in Fruitland. With men away at

work outside the reservation, the women are left to do much of the farm work. Remuneration from farming does not, however, offer enough incentive to work. Women complain of the laborious work involved. Women's home functions have been greatly curtailed through the introduction of labor saving devices, the increased consumption of semifinished and finished goods (food and clothing), and the assumption by the school of child training functions. Especially in the fall and winter, idleness, boredom and restlessness prevail. With little happening either in the home or in the community, and with both men and children away, the women also desert the home in search of excitement in town; they go to meet friends, gossip, shop around, go to the show, or get drunk. As a result of women's economic dependence and their loss of important functions, there has also been a lowering of their bargaining position in family interaction.

337 pages. \$4.21. MicA54-2795

**A STUDY OF CHINESE COMMUNITY
LEADERSHIP IN BANGKOK, TOGETHER WITH
AN HISTORICAL SURVEY OF
CHINESE SOCIETY IN THAILAND**

(Publication No. 9801)

George William Skinner, Ph. D.
Cornell University, 1954

This study is in two parts, the first of which traces the development of Chinese society in Thailand from the 13th to the 20th centuries. The first Chinese settlements were established at Gulf ports in connection with the Chinese junk trade. By the early 15th century, Chinese were permanently settled in the Thai capital at Ayutthaya. The rate of Chinese immigration tended to increase steadily up to the first decade of the 20th century. Immigration was given impetus during the reign of King Taksin (1767-82), but reached mass proportions only after 1882, when direct steamer traffic was inaugurated between Swatow and Bangkok; its all-time peak was attained in 1927-28. The ethnic Chinese population is estimated to have increased from about 10,000 in the 17th century to 175,000 in 1850, over 600,000 in 1900, and approximately 2.75 millions in 1952.

Chinese in the Ayutthayan period lived in "camps" headed by Chinese captains ennobled by the crown and formally incorporated into the Thai bureaucracy. Bangkok was founded in 1782, and Chinese have always formed between two- and three-fifths of its population. 19th-century Chinese society was characterized by high upward mobility, and was vertically organized into divisive secret societies and guilds.

There was no community-wide leadership, the most prominent Chinese being monopoly farmers and secret-society leaders. High rates of assimilation prevailed, and the development of a stable elite and leadership corps was precluded by the Thai government policy of ennobling eminent Chinese and drawing them into the Thai elite.

The period around 1910 was one of transition. The growth of Chinese and Thai nationalisms precipitated trends within overseas Chinese society from underground activity toward legitimacy, from division toward cohesion, from informal toward formal organization, from social anarchy toward community responsibility. The Thai government's gradual shift from a proassimilationist policy to one of containment during the inter-war years and the success of the Kuomintang in China encouraged militant nationalism within local Chinese society.

Part II is a study of Chinese community leadership. The approximately 490,000 Chinese in metropolitan Bangkok are led, at the community level, by about 200 men. Most of them are bound together by an elaborate system of interlocking business directorates and associational officerships into a single structure, analyzed into eight major power blocs. The Chinese elite is defined as those in highest possession of wealth, prestige and power, while members of the elite who affect the policies of the community and its members are held to be community leaders. 185 of the most influential leaders are ranked according to wealth, prestige and power, and the hypothesis that these values agglutinate within the Chinese elite is tested and confirmed.

135 of the most prestigious leaders were interviewed, and the data subjected to a statistical and qualitative analysis. The leaders are predominantly Teochius (62%), businessmen (90%), China-born (72%), self-made (61%), monogamous (65%), and left-wing or neutralist in politics (56%). Most of them have had less than 12 years of schooling (60%); speak Teochiu (92%) and Thai (83%); and have resided for more than 25 years in Thailand (70%). These and a score of other variables are cross-tabulated to test hypotheses about the leadership corps.

The most influential Chinese leaders tend to be the more Thai-ified, and most of them have since 1948 entered into business cooperation with the Thai elite. This situation is shown to follow from the community's need for protection from and "diplomatic" relations with the Thai ruling class, and from its high valuation of wealth and business success. Successful businessmen tend to be conservative and are especially vulnerable to Thai power. Consequently militant or radical leadership vis-à-vis the Thai ruling class as well as the development of a stable Chinese elite stratum is unlikely.

842 pages. \$10.53. MicA54-2796

BACTERIOLOGY

BACTERIOLYSIS BY DUAL-ENZYME SYSTEMS CONTAINING LYSOZYME

(Publication No. 9855)

Maurice E. Becker, Ph. D.
Purdue University, 1954

Major Professor: S. E. Hartsell

In an attempt to elucidate the mechanism of lysozymic bacteriolysis, the lytic effect of dual-enzyme systems, containing lysozyme and one of several other enzymes, was followed spectrophotometrically. Only proteolytic enzymes, as papain, pepsin, and particularly trypsin, produced significant clearing, either alone or in combination with lysozyme. Trypsin and lysozyme, acting simultaneously, effected extensive lysis of 13 gram positive and gram negative species, provided the cells were first subjected to a mild heat treatment. Organisms which remained resistant, even after heating, were always rendered lysable by these enzymes following treatment with one of several other physical or chemical agents.

The lytic rate as well as total lysis, which resulted after incubation of these pretreated suspensions with the dual-enzyme system, was often far greater than could be accounted for on the basis of additive action of component enzymes. It was therefore considered to be a true synergistic response.

Among the factors influencing the enzyme synergy, as manifested by experiments on heated preparations, were: amount of previous heat treatment, incubation temperature, pH, age of cells, concentration of enzyme, and turbidity of the cell suspension. Combined action was often optimal under conditions of temperature, pH and heat treatment, that were far removed from the corresponding optimum of either enzyme alone.

The mechanism of the synergistic phenomenon was studied, using techniques previously shown to give maximum response. One such method involved the use of physically disrupted cells. Because such cells exhibited about the same resistance as did similar unheated, intact suspensions, it was concluded that permeability, *per se*, was not the responsible factor for the non-lysability of unheated preparations.

Another procedure used in delineating the mechanism of combined enzymatic lysis, involved the study of consecutive versus concomitant action. Results indicated that the two were not comparable; for, lysozyme action, followed by incubation with trypsin, gave as much as 80 to 100 per cent more total lysis than did the reverse sequence.

In a third technique, various other physical and

chemical pretreating agents were employed. Alternate freezing and thawing rendered cells only moderately sensitive to the dual-enzyme system; UV light and drying had almost no effect. Chemical pretreatment, however, proved to be one of the most successful means of ensuring lysability. Dilute alkali was especially effective, in that it rendered the most resistant species lysable, sometimes even by lysozyme alone (*Micrococcus pyogenes* var *albus*, *Sarcina aurantiaca*). Ethanol, though less effective on gram positive, lysozyme-resistant species, rendered most gram negative and some gram positive organisms (*M. pyogenes* var *aureus*) lysable by the dual-enzyme system. Pretreatment with methanol or chloroform proved equally effective.

Implications of these studies as regards the presence, disposition and availability of cellular enzyme substrate, and the relation of such to the mechanism of lysis, appear most promising.

137 pages. \$1.71. MicA54-2797

STUDIES ON EQUINE LEPTOSPIROSIS

(Publication No. 9909)

John Thomas Bryans, Ph. D.
Cornell University, 1954

The demonstration of leptospiral agglutinins in the serum and the aqueous humor of horses affected with periodic ophthalmia confirms the reports of other authors.

We observed two cases of periodic ophthalmia in horses known to have been naturally infected with *Leptospira pomona*. The apparent incubation period from the onset of the leptospiral infection to the first occurrence of ophthalmia was a year in one animal and 2 years in the second. Attempts to recover leptospirae in culture from the blood, eye, and urine of one of these horses and from the affected eyes and other organs of five additional cases of periodic ophthalmia were unsuccessful. The evidence for a leptospiral etiology in periodic ophthalmia of horses is primarily serological. This type of evidence, although highly suggestive, does not furnish convincing proof of etiology. Our failure to isolate leptospirae from six typical cases of periodic ophthalmia does not lend support to the idea that this organism is the causative agent of the disease.

Serological evidence is presented which indicates that leptospirosis is a relatively common infection of horses. Thirty percent of a group of 512 serums from brood mares and other mature horses had agglutinins for either *L. pomona*, *L. icterohemorrhagiae*,

or *L. canicola*. The majority of reacting serums (95) contained agglutinins for *L. icterohemorrhagiae*. No agglutinins for these serotypes were found in the serums of 492 weanling horses.

The results of studies on experimentally produced *L. pomona* infections in six mature horses characterized the infection as a transient hemolytic anemia with grossly visible icterus in the more severely affected animals. Fever persisted for 3 to 5 days and temperature peaks of 103° to 106° F were reached. The disease ran a mild course and all horses recovered without apparent residual damage. Leptospirosis was not detected in any of the horses infected during these experiments. *L. pomona* was recovered from the kidneys, but not from the urine, of two horses destroyed immediately after disappearance of fever. The kidneys of horses destroyed at later intervals in convalescence were negative to culture. Other organs cultured including the lungs, liver, spleen, and eyes were negative. Although other workers have reported leptospirosis in horses infected with *L. pomona*, the results of our experiments tend to minimize the role of horses as chronic carriers of this spirochete.

Leptospirosis in horses, as caused by *L. pomona*, does not present pathognomonic symptoms. Diagnosis must be confirmed by blood culture or by serology. Leptospiral agglutinins may persist in high titer in horses for more than 2 years. The finding of a rising serum agglutinin titer against leptospirae is therefore necessary for serological diagnosis. Blood cultures are positive in experimental cases only during the first 2 or 3 days of fever, cultures may be negative during the final days of fever and the disappearance of the septicemic stage is closely correlated with the appearance of serum antibody.

Because of the mild nature of the disease in horses and the failure to demonstrate a carrier state in our experimental animals leptospirosis is believed to be of little importance to the light horse industry. The finding of more direct evidence for the role of leptospiral infection in periodic ophthalmia will require modification of this viewpoint.

68 pages. \$1.00. MicA54-2798

ELECTROPHORETIC AND SERUM NEUTRALIZATION STUDIES OF SERA FROM CHICKENS EXPOSED TO INFECTIOUS BRONCHITIS VIRUS

(Publication No. 9941)

George T. Dimopoulos, Ph. D.
Michigan State College, 1952

This study was undertaken to ascertain any possible correlations between electrophoretic and serum neutralization analyses of sera from chickens exposed to infectious bronchitis virus (IBV).

Adult Single Comb White Leghorn cockerels were divided into four groups as follows:

- Group I - Controls-bled at weekly and monthly intervals.
- Group II - Birds inoculated with IBV and bled immediately prior to inoculation and then at one, two, three, four, six, eight, ten, 12, 16, and 20 weeks.
- Group III - Birds treated as those in Group II but challenged at the twelfth week and bled one, three, five, and seven weeks after challenge.
- Group IVa - Birds inoculated with a normal lung and tracheal suspension and bled immediately prior to inoculation and then at one, two, and three weeks.
- Group IVb - Birds subjected to scarification of the trachea and bled immediately prior to scarification and then at one, two, and three weeks.

Sera were diluted to a final protein concentration of two per cent (5), dialyzed (4), and analyzed electrophoretically in veronal buffer (2) at pH 8.6, 0.1 ionic strength using a potential gradient of 6.5 volts/cm² for 7,600 seconds. The results are expressed as relative per cent serum protein component.

For the serum neutralization test (1) equal portions of ten-fold dilutions of IBV and undiluted serum were mixed, incubated and inoculated into embryonating chicken eggs. Results are expressed as the Lethal Dose₅₀ Neutralization Indices (LD₅₀ NIs) (3).

Sera from normal birds bled at weekly intervals showed an increase of approximately 0.20 from the initial albumin/globulin ratio of 0.85 during the first and second weeks. After this period the ratios decreased 0.40 to 0.60 of the initial value.

Sera from normal birds bled at four-week intervals showed no significant changes in the relative per cent distribution of serum protein components.

Birds exposed to IBV showed marked decreases in the albumin/globulin ratios to an average value of 0.45 during the first and second weeks. The ratios steadily increased after this period and returned to normal at the twelfth week. The normal values of 0.85 persisted for eight additional weeks.

The LD₅₀ NIs increased slowly at the first and second weeks after exposure. After this period a marked increase occurred. Maximum LD₅₀ NI values of 10⁶ were reached between the sixth and eighth weeks and decreased after this period to approximately 10³ at the twentieth week.

No correlation was observed in the changes of electrophoretic patterns and changes in the LD₅₀ NIs. When electrophoretic patterns had returned to normal the LD₅₀ NIs were at their maximum values of 10⁶.

Birds challenged at the twelfth week did not show any significant changes in their electrophoretic patterns but showed increases in the LD₅₀ NIs to maximum values of 10⁷.

The changes in electrophoretic patterns were not considered specific for IBV since normal birds bled at weekly intervals showed similar changes.

Sera obtained from birds inoculated with a normal lung and tracheal suspension and birds subjected to a scarification of the trachea showed varying results in the changes of albumin/globulin ratios. Results obtained did not give evidence that these treatments alone were responsible for the changes observed. There were no changes in the LD₅₀ NIs.

Bibliography

1. Cunningham, C. H., *A Laboratory Guide in Virology*, Burgess Publishing Company, Minneapolis, 1948.
 2. Longworth, L. G., Recent Advances in the Study of Proteins by Electrophoresis. *Chem. Rev.*, 30: 323-340, (1942).
 3. Reed, L. J., and Muench, H., A Simple Method of Estimating Fifty Per Cent Endpoints. *Am. J. Hyg.*, 27: 493-497, (1938).
 4. Reiner, M., and Fenichel, R. L., Dialysis of Protein Solutions for Electrophoresis. *Science*, 108: 164-166, (1948).
 5. Sanders, E., Huddleson, I. F., and Schaible, P. J., An Electrophoretic Study of Serum and Plasma from Normal and Leucosis-affected Chickens. *J. Biol. Chem.*, 155: 469-481, (1944).
- 216 pages. \$2.70. MicA54-2799

SOME FACTORS AFFECTING GROWTH AND AMYLASE PRODUCTION BY *BACILLUS STEAROTHERMOPHILUS* ATCC 7954 ON COMPLEX AND SYNTHETIC MEDIA

(Publication No. 9869)

Paul Arthur Hartman, Ph. D.
Purdue University, 1954

Major Professor: P. A. Tetrault

An amylase preparation obtained from a thermophilic species was shown to be more heat stable at 70, 80 and 90° C than three commercially available amylase preparations from mesophilic bacteria. The thermophilic amylase activity was stable within a pH range of 5.75 to 7.0 at 60° C for 92 hours.

On complex media *B. stearothermophilus* ATCC 7954 gave higher yields of amylase activity than 166 other strains of stenothermophiles tested. The above strain was used for further studies. For amylase formation the pH optimum was 7.3 to 7.5, the optimum temperature was about 75.5° C.

More amylase was obtained on media supplemented with starch than with glucose. Little difference was observed between cultures grown on media containing starch initially and cultures fed starch periodically during the course of the fermentation. Dimalt possessed better growth promoting properties than the corn steep liquor, yeast products or vitamins tested. Nitrate (KNO₃, NH₄NO₃ or NaNO₃) increased amylase yields in a trypticase medium. The best laboratory medium developed was: 2.0 per cent

trypticase, 0.4 per cent N-Z-Case, 1.0 per cent Dimalt, 0.5 per cent KNO₃ and 0.1 per cent starch. The use of rapid transfer of inocula, heat shocked inocula, added Na₂SO₄, fats, vitamins or sodium citrate did not appreciably increase amylase yields in the above medium. Glid-S-O (Glidden Co.) was the best inexpensive commercially available nutrient tested for amylase production.

B. stearothermophilus ATCC 7954 required (ug./10 ml.): 0.005 biotin (or desthiobiotin), 1.125 niacin and 0.1 thiamine for growth on synthetic media. In a basal salts medium containing minimal quantities of vitamins about 100 ug. of sulfate-S/10 ml. was needed for optimum growth. Biotin and/or thiamine could be metabolized as a sulfur source in the absence of another source. Ammonium sulfate or casamino acids could be used as a source of both sulfur and nitrogen. In the presence of sulfate; ammonium chloride, urea or asparagine were satisfactory nitrogen sources; but ammonium lactate and potassium or sodium nitrate were not. From 0.5 to 8.0 mg. of N/10 ml. could be used: 1.0 to 2.0 mg. N/10 ml. appeared to be optimum.

Carbon sources containing the alpha-1,4-glucoside bond were more satisfactory than other carbon sources for amylase formation. Large quantities of acid were produced from any carbon source metabolized. Phosphate and trans-aconitic acid - tri-ethanolamine buffer pairs were toxic in concentrations and combinations necessary to keep the pH of the medium neutral. The concentrations of ferric chloride used did not affect the final pH of the medium. Calcium carbonate was the best buffer tested, even though the increased solubility of calcium carbonate in media containing ammonium and other ions sometimes resulted in elevation of the pH of the medium to unfavorable levels, especially at the high incubation temperature of 60° C.

The thermostable enzyme behaved in a fashion similar to mesophilic bacterial amylases under preliminary purification procedures.

The above results were discussed in relation to data published on mesophilic bacterial amylases. Certain Russian publications and unpublished American works were reviewed in the Literature Survey.

197 pages. \$2.46. MicA54-2800

PHYSIOLOGICAL FACTORS INFLUENCING SPORE GERMINATION OF SOME FOOD SPOILAGE BACTERIA

(Publication No. 9870)

Fred Heiligman, Ph. D.
Purdue University, 1954

Major Professor: Norman W. Desrosier

One of the problems in the commercial processing of tomato juice is flat-sour spoilage. This spoilage is due, primarily to the activity of *B. thermacidurans*. The vegetative cells of this bacterium

can spoil tomato juice when adapted to this substrate. The spores spoiled the product only if given a mild heat treatment just prior to the inoculation of the product. Phosphate ions played an important role in the germination of the spores. Spores did not germinate in a medium low in phosphate. As the phosphate ion concentration of the medium was increased, the time for the germinating spores to pass through the lag phase of growth became progressively shorter. Other ions did not appear to affect germination. A major cause of flat-sour spoilage of tomato juice may be due to the heat-activation of spores which survive the processing of the product and/or variations in the concentrations of the available phosphate ions in different lots of tomato juice.

To study the effects of mild heat treatments on spores, various methods were studied for preparing vegetative-cell-free spore suspensions without the use of heat. Of all the agents tested, ultra-sonic irradiation gave the best results. Short time exposures of suspensions of mixtures of vegetative cells and spores to this agent were found to have a strong lethal action on the vegetative cells, yet had little lethal effect on the spores.

A portion of potentially viable spores needed a mild heat treatment before they would germinate and grow when placed in a favorable environment. Heat activation studies revealed that, by the treatment of spore suspensions with different levels of sub-lethal heat, a time temperature relationship for maximum recovery existed. The reaction appears to be a first order reaction.

Upon storage, spore suspensions which had been activated with a mild heat treatment were found to lose their activation, and could be reactivated by subsequent heat treatments. These results indicate that some biologically active material or materials, associated with the spore germination process, is activated by mild heat. It is suggested that most spores contain an ample quantity of these materials in a reactive state and that they do not require an energy of activation in order to initiate germination. Those spores which do not germinate without a heat treatment contain relatively low concentrations of these materials, thus, without energy of activation not enough of the materials exist in a reactive state to initiate germination. It is possible, however, that some anti-germination factors, present in or associated with the spore, were destroyed by the heat and that the spores, upon storage, synthesized these anti-germination factors.

A comparison of thermal-activation-time curves and thermal-death-time curves show that the spores of species which were relatively easily activated by heat were also relatively easily destroyed by heat. Spores of species which were more resistant to heat also required a more drastic heat treatment for maximum recovery. These results suggest that the factors associated with the thermal activation of spores are related to the factors associated with the thermal death of spores.

Studies on spore germination (as defined by the loss of heat-resistance of the spores) indicated that spores are complete entities within themselves and

require only sources of materials which they can utilize for the production of energy in order to germinate. It was found that spores could germinate in substrates containing only glucose and phosphate. It was found also that spores of *B. thermoacidurans* could utilize only those sugars and related compounds that the vegetative cells of the species can utilize for growth *per se*. Spores apparently contain the necessary nitrogenous materials required for germination because germination proceeded in environments void of nitrogen containing materials.

The results of these studies show that spores can germinate not only in glucose, but also in all of the intermediate metabolites of glucose metabolism that were studied. Germination of spores in these substrates was found to be inhibited when certain specific respiratory inhibitors were included in the substrate. Studies of spore germination in substrates of these intermediate metabolites indicate that by blocking the reactions which yield energy, germination was also blocked. The inhibition appeared to be quantitative. The probable sites of inhibition and the mode of action of these inhibitors are discussed.

158 pages. \$1.98. MicA54-2801

CHARACTERIZATION OF SOME LACTOBACILLI FOUND IN MILK

(Publication No. 9182)

Robert Gordon Jensen, Ph. D.
University of Missouri, 1954

One hundred two isolations of lactobacilli were made from 491 samples of milk and cream comprised as follows: Grade A raw, 256; Grade C raw, 29; aseptically drawn, 63; sour cream 41; Grade A pasteurized, whole, 56; Grade A pasteurized, skim, 7; and Grade A cream, 13. The enrichment technique followed by plating with plain V-8 juice or Briggs' agar was superior to direct plating with Rogosa's SL agar. Fabian's brom cresol green agar did not support the growth of known strains of *L. acidophilus*, *L. bulgaricus* and *L. lactis* at the dilutions employed. Briggs' agar modified by adjusting the pH to 5.7 and adding 0.1 per cent brom cresol green was a good selective differential medium.

Thirty-two named and 102 isolated cultures were classified by the methods of Tittsler *et al.*, and Briggs, with additional information from the work of Rogosa *et al.*; 80.3 per cent of the isolates were homofermenters, 19.7 per cent were heterofermenters. Seven cultures of *L. acidophilus*, one of *L. bulgaricus*, 51 of *L. casei*, two of *L. lactis*, 19 of *L. plantarum*; two of homofermentative unidentified, four *L. brevis*, eight *L. fermenti* and eight heterofermentative unidentified were found. The classification of both the named and the unknown cultures by Briggs' method is presented.

Variation in colonial appearance and sugar fermentation was very slight. No difficulty was experienced in obtaining consistent and reproducible

results. Homofermentative cultures whose colonies appeared rough did not grow in a defined medium, a 4 per cent NaCl medium or at 16° C, but they all grew at 45° C. Homofermentative cultures with smooth appearing cultures grew in both media and at 16° C.

The results indicate that Briggs' classification should be used as a screening method and that further confirmation will almost always be necessary.

The best sources of the lactobacilli in this study were high count Grade A and C raw milks and sour cream. However, cultures were isolated from all the types of milk and cream studied. Two cultures found in the aseptically drawn samples were considered to be contaminants. Source type and plate count data are presented.

Twenty-two (21.5 per cent) of the cultures survived laboratory pasteurization at 61.8° C. in Briggs' broth. The cultures which survived were as follows: *L. acidophilus*, 1; *L. casei*, 15; *L. bulgaricus*, 1; *L. lactis*, 2; and *L. plantarum*, 1. Only three out of eight cultures isolated from pasteurized milk and cream survived laboratory pasteurization.

Ninety and one-tenth per cent of the cultures were classified by Tittsler's method and 97.0 per cent by Briggs' method. 95 pages. \$1.19. MicA54-2802

PARTIAL FRACTIONATION BY ULTRA-CENTRIFUGATION OF NEWCASTLE DISEASE VIRUS INTO COMPLEMENT FIXATION AND AN INFECTIVE FRACTION

(Publication No. 9945)

Rother Rodenious Johnson, Ph. D.
Michigan State College, 1954

Complement fixation studies were done on an antigen consisting of Newcastle disease virus in hamster brains.

In the first series of experiments, the complement fixation tests were carried out on the supernatant fluids and sediments of the first and second cycles of ultracentrifugation. It was found that the virus was removed from the medium at 114,000 time gravity. The sediments contained infective virus, complement fixing components and was capable of agglutinating erythrocytes. Both first and second cycle supernatant fluids were inactive for these three components.

In the second experiment, a sample of the antigen was subjected to ultrasonic vibration prior to ultracentrifugation. As a result of this treatment, the supernatant fluids of both cycles of centrifugation contained complement fixing properties but were not infectious nor did it produce hemagglutination. Like the first experiment, the sediments from both cycles of centrifugation were infectious, fixed complement, and produced hemagglutination.

The experiments, therefore, show that Newcastle disease virus contains a soluble complement fixation antigen. Besides other serological similarities,

Newcastle disease virus compares to the related influenza viruses in this respect.

84 pages. \$1.05. MicA54-2803

THE EFFECT OF NEWCASTLE DISEASE VIRUS ON SUSCEPTIBLE AND RESISTANT TISSUES CULTURED FROM CHICKENS AND RABBITS

(Publication No. 9946)

Agnes Lenore Jones, Ph. D.
Michigan State College, 1954

In these experiments a comparative study has been made on the effect of Newcastle Disease Virus (N.D.V.) on susceptible and resistant tissues cultured from chickens and rabbits.

Embryonating chicken, adult chicken lung, liver and spleen and adult rabbit lung, liver, spleen and lymph node tissues were cultured. Both normal and immune adult chickens and rabbits were used. Hemagglutination and infectivity tests were carried out to determine the growth curves of N.D.V. in embryonating chicken tissues.

The growth cycle was composed of (a) a lag phase of 24 hours, (b) a phase of rapid virus multiplication in which peak infectivity titers were reached in 36 hours and peak hemagglutination titers in 36 to 48 hours, (c) a plateau lasting 48 to 60 hours, (d) a sudden decrease in the rate of virus production 96 hours after N.D.V. inoculation.

Growth curves prepared from hemagglutination titrations on the tissues cultured from normal adult chickens and rabbits were similar to those of the embryonating chicken tissue but the peak hemagglutination titers occurred 36 to 96 hours after N.D.V. inoculation. This was also found in the immune chicken lung and spleen cultures but not in the liver cultures. In the immune chicken liver tissues and in all the tissues of the immune rabbit there was a steep decrease in infectivity titers from an LD₅₀ of 10⁻⁷ on the day of inoculation to 10⁻¹ or 10⁻² 48 hours later. Hemagglutination activity was recovered only in the undiluted fluids from the immune chicken liver cultures.

Cytological degeneration was seen in the embryonating chicken cultures 15 to 48 hours after N.D.V. inoculation. The fibroblasts showed an increase in vacuolization of the cytoplasm and a tendency in the formation of giant cells which contained 3 to 5 nuclei. The only degenerative changes in the adult tissue cultures occurred in normal adult chicken liver and this did not appear until 7 or 8 days after N.D.V. inoculation. There was a gradual degeneration of the liver cells in which the cytoplasm lost its staining properties and broke up into large granules and the cell wall became fragmented. The nucleus, however, was unaltered. Neither the uninoculated cultures nor the cultures inoculated with heat-inactivated N.D.V. showed any degenerative change.

74 pages. \$1.00. MicA54-2804

PURINE METABOLISM IN BACTERIA

(Publication No. 8563)

Samuel Harris Love, Ph. D.
University of Pennsylvania, 1954

Supervisor: Dr. Joseph Gotz

The biosynthesis of 4-amino-5-imidazolecarboxamide (AICA), a postulated purine precursor, by non-proliferating suspensions of *Escherichia coli* was studied by employing a purine requiring mutant (strain B-96) which accumulates this metabolic product. The carbon and energy requirement for the synthesis of AICA were best supplied by glucose, gluconate, L-arabinose, D-galactose, or glucose-1-phosphate. The rate of formation was directly parallel with the rate of glucose utilization and aeration enhanced formation. The utilization of L-arabinose for AICA synthesis was adaptive. Nitrogen requirements could be supplied by inorganic ammonium salts, but more efficiently by casein hydrolysate. Serine, glutamic acid and aspartic acid served as nitrogen donors; histidine, threonine, glycine and aspartic acid were able to stimulate synthesis in the presence of an optimal supply of inorganic nitrogen. Methionine, -aminobutyric acid, valine, and homoserine were inhibitory. Varying degrees of inhibition were also obtained with formate, acetate, citrate, -keto-glutarate, malate and ascorbic acid. A series of imidazole and malonic acid derivatives were unable to contribute to the formation of AICA.

Several purine requiring mutants of *E. coli* are known to accumulate AICA in the form of a ribotide. One purineless mutant (strain W-11) has been found which accumulates another imidazole ribotide (or riboside) different from that of the imidazolecarboxamide. The differences are apparent by analysis of ultraviolet spectra, spectra of the dyes produced with the Bratton-Marshall test for diazotizable amine, color reaction with the Pauly reagents for imidazole and mobility patterns on paper chromatograms. Using eluates from the chromatograms, it was shown that the new imidazole derivative could be completely converted to the imidazolecarboxamide by non-proliferating suspensions of strain B-96 which accumulates the latter. Glucose was required for this conversion. With suspensions of the wild-type organism, a slow disappearance, but no conversion, was evident. Attempts to isolate the new imidazole have been hampered by its apparent lability to acid treatment, high temperature and oxidation. A differential loss of properties during the isolation procedures suggested at least 2 separate substances. This was verified when 2 independent fractions were obtained by means of chromatographic flow through a paper pulp column. One fraction contained the diazotizable amine and its associated pentose; the other fraction showed the typical ultraviolet absorption with peak at 300 mμ and an associated yellow color. The present information strongly suggests that the major substance accumulated by this mutant is an aminoimidazole ribotide (or riboside) derivative which functions as a precursor to the ribose

derivative of 4-amino-5-imidazolecarboxamide, and therefore to purines.

39 pages. \$1.00. MicA54-2805

MULTIPLICATION OF UNRELATED PLANT VIRUSES IN DOUBLE INFECTIONS

(Publication No. 9924)

William Frantz Rochow, Ph. D.
Cornell University, 1954

The multiplication of one plant virus was found to be affected greatly by the simultaneous multiplication of a second virus. Determinations were made of the ratio of the amount of a mild strain of potato virus X in juice from tobacco plants doubly infected with virus X and an unrelated virus to that in juice from comparable plants infected by virus X alone. Assays of virus X were made by means of local lesions on plants of *Gomphrena globosa* in most cases. When leaves were sampled in the acute stage of infection, this ratio reached 10:1 with potato virus Y, 6:1 with tobacco etch virus, and 2:1 with cucumber mosaic virus. Double infections with alfalfa mosaic virus did not result in a change in the relative concentration of virus X, while double infections with tobacco ringspot virus resulted in as much as a 50 per cent decrease in virus X concentration. At the dilutions used, these five viruses did not interfere with the biological assay of virus X. In combination with tobacco mosaic virus, virus X could be assayed only by serological methods. Precipitin tests showed at least a 4-fold increase in virus X antigen in juice from leaves doubly infected with virus X and tobacco mosaic virus over that in juice from X-infected leaves.

In all cases where the relative concentration of virus X increased in double infections, a corresponding increase in severity of symptoms of the acute stage of infection occurred.

The relative activity of virus Y in juice from XY-infected leaves in the acute stage of infection was the same as that in juice from comparable Y-infected leaves. The relative concentration of active tobacco mosaic virus was slightly reduced in double infections with virus X.

Studies on double infections following simultaneous inoculation with viruses X and Y showed that the ratio of virus X in juice from XY-infected plants to that in juice from comparable X-infected plants varied with the stage of infection. Ratios up to 10:1 were obtained only with juice from leaves in the acute stage of infection. Ratios up to 3:1 were obtained with juice from leaves in the chronic stage of infection, while the doubly inoculated leaves contained up to twice as much virus X as singly inoculated ones.

During the acute stage of the disease, a greater relative increase of virus X in the presence of virus Y occurred in the midrib and main lateral veins than in the vein islets. Juice from the vein islets of

X-infected leaves contained about six times more active virus X than did juice from the midribs and main lateral veins. Juice from the vein islets of XY-infected leaves contained about twice as much active virus X as did juice from the midribs and main lateral veins of these leaves - the same relationship as shown by virus Y in juice from these tissues of doubly or singly infected leaves.

Maximum increases in the amount of virus X in doubly infected plants appeared to occur only during the rapid phase of multiplication of virus Y. When X-infected plants were inoculated with virus Y, increases in relative concentration of virus X similar to those of simultaneously inoculated, doubly infected plants occurred. When Y-infected plants were inoculated with virus X, large increases of virus X and severe symptoms of the acute stage of infection were lacking.

Assays of relative concentration of virus X in double infections with virus Y made by means of local lesions on plants of *Gomphrena globosa*, by electron microscope particle counts, and by precipitation tests were in agreement.

86 pages. \$1.08. MicA54-2806

STUDIES ON THE ADAPTATION OF INFECTIOUS BRONCHITIS VIRUS OF CHICKENS TO MICE

(Publication No. 9954)

Nathan L. Shipkowitz, Ph. D.
Michigan State College, 1952

This study was undertaken in an attempt to ascertain if the virus of infectious bronchitis of chickens is capable of growing in Swiss albino mice. The importance of such a study is that experimentally produced virus variants have, in many instances, resulted in a reduction in the virulence without drastically altering its antigenicity, so that the new strain could serve as a protective agent against the original virulent form of the virus.

Chicken-propagated and egg-propagated strains of the undiluted and diluted virus were carried through six intranasal mouse-passages. The lungs in the first two passages showed slight congestion. The lungs in the last four passages were normal. The embryo mortality was negligible indicating that the virus was no longer present in the lungs and that the virulence of the virus for mice did not increase as the serial mouse-passage was continued.

The experiments to determine the exact time the undiluted egg-strain of the virus could be retained after intranasal inoculation of mice indicated that the virus would persist in the lungs for 12 hours but not for 16 hours.

It was possible to carry the egg strain of the virus through three mouse-passages by use of the alternate ("zig-zag") intranasal passage. The virus was passed through mice, then eggs, and then back through mice. The virus persisted for a period of 17 hours in the third mouse-passage.

In the experiments to determine whether variation in the routes of inoculation would aid in the adaptation of the undiluted egg strain of the virus it was found that following the intraperitoneal, intravenous, and intracerebral routes; the virus could not be recovered.

Serial intranasal passage of both strains of the virus through three-day old suckling mice indicated that the virus was unable to be retained.

The experiments to determine the length of time both strains of the virus could be retained by intranasal inoculation into three-day old suckling mice, indicated that the virus could not be retained in the lungs.

98 pages. \$1.23. MicA54-2807

THE USE OF HYDROGEN AND ORGANIC ENERGY SOURCES BY *HYDROGENOMONAS* sp.

(Publication No. 9906)

Elizabeth Wilson, Ph. D.
Purdue University, 1954

Major Professor: D. M. Powelson

The results of manometric and plating experiments have indicated that *Hydrogenomonas* is a facultative autotroph and can utilize either hydrogen or organic compounds, or both, whether it has been grown autotrophically or heterotrophically. Since the organisms possess this facultative characteristic it has been possible to compare synthetic pathways under autotrophic and heterotrophic conditions in the same bacterial population. This was done by comparing the radioactive compounds formed after short term exposure to $C^{14}O_2$ when heavy suspensions of cells were supplied either hydrogen or pyruvate as the source of energy. The only compounds in which radioactive label was detected were amino acids and organic acids. The fraction of the cell extracts which would contain neutral compounds possessed no detectable radioactivity.

Radioactive malic, aspartic, and glutamic acids were identified following the exposure of *Hydrogenomonas* to $C^{14}O_2$ when either hydrogen or pyruvate was supplied as the source of energy. The presence of these labeled compounds indicates the operation of the Krebs tricarboxylic acid cycle. Further evidence for the operation of this cycle is furnished by the presence of citric and alpha-ketoglutaric acid in the extracts of cells which had been supplied pyruvate as the source of energy. Radioactivity was detected also in glycine, glycolic acid, oxalic acid, glutamine and possibly glyceric acid. Several labeled organic acids remain unidentified. Among these unidentified organic acids are some which were produced by the cells in the presence of hydrogen but not in the presence of pyruvate, and vice versa; these compounds did not appear in the endogenous extracts.

The significance of the labeled compounds in the metabolism of *Hydrogenomonas* can be evaluated more fully when the location of the label in each compound has been determined by future investigations.

137 pages. \$1.71. MicA54-2808

BIOLOGY — GENETICS

STRAWBERRY PROGENY TESTING AND EVALUATION OF PARENTS FOR BREEDING

(Publication No. 9611)

Roland Charles Blake, Ph. D.
University of Minnesota, 1954

Advisor: A. N. Wilcox

In the furtherance of the strawberry breeding program at the University of Minnesota, certain cross and self progenies were studied with respect to several plant and fruit characters of economic importance for the following purposes: (1) to estimate the breeding value of certain parents, (2) to investigate the performance of parents in various types of crosses, and (3) to develop information for the improvement of methods of testing. These studies included three experiments, with a total of 3072 seedlings from crosses and 216 seedlings from selfs, and with field notes taken during four seasons, from 1949 to 1952.

The seedlings were planted 4 1/2 feet apart and were allowed to develop into clonal hills. The characters studied were time of blossoming, time of ripening, rate of ripening (days from blossoming to ripe fruit), productiveness (relative yield of fruit), and the fruit characters of attractiveness, size, outside and inside color, and quality (desirability of flavor).

In Experiment 1 nine inbred clones were used as parents. These were intercrossed in all possible combinations and were selfed. The progenies were planted in a replicated test with the several progenies of each parent in close proximity. Comparisons were made with respect to general combining ability (mean of crosses with eight other parents), specific combining ability, and self progeny means. For all characters, except productiveness, highly significant differences were found in the general combining ability means of the nine parents. In general, the parents held similar rank with respect to their general combining ability means, specific combining ability means, and self progeny means. Although self progeny means were compared with a lower degree of accuracy than either general or specific combining ability means, nevertheless, significant differences were found between the self progenies with respect to all characters except productiveness, size of fruit, and inside color of fruit.

In Experiment 1 the correlations between general combining ability means and self progeny means of the nine inbred parents were positive for all the characters studied. Ten of the 12 correlations which were calculated reached the 5 per cent level of significance, indicating the feasibility of using self progenies in testing and breeding value of inbred parents for the characters studied.

The general similarity in rank of the parents whether judged by general combining ability means, specific combining ability means, or self progeny means, in conjunction with the much greater range of the self progeny means, led to the conclusion, in agreement with that of Peterson (1952), that the self progenies should furnish the most efficient test of breeding value with respect to these characters, providing that the progenies were grown in experiments designed for appropriate error control.

In the other two experiments, the progenies were all from crosses. The parents were, with a single exception, either inbred clones or selected hybrids between such clones, so that the progenies might be considered as single crosses, three-way crosses, and double crosses of inbred parents. The exceptional parent was a selection of the wild *Fragaria virginiana* Duch. Significant differences between progenies were found for all characters studied. Many of these differences were attributable to certain parents. Differences were often found between sister selections with respect to their ability to transmit particular characters to their progenies. The reciprocal crosses between the same two parents were never found to differ significantly.

128 pages. \$1.60. MicA54-2809

A STUDY OF ACETATE IN GROWTH AND GLYCOSIDE FORMATION IN DIGITALIS PURPUREA

(Publication No. 10,005)

Er Hung Djao, Ph. D.
University of Washington, 1954

In view of the specific role of acetate as a precursor in the biosynthesis of various steroid compounds in animals and plants, a study of the role of certain acetate feedings in the growth and the steroid glycoside formation in *Digitalis purpurea* was undertaken. Hydroponic culture methods and isotope tracer technique were employed in this study.

First attempts in this study were made to examine the effects of acetate upon the quantity of total glycoside produced in *Digitalis purpurea*, during which nonradioactive acetates were employed. A series of concentrations ranging from 0.0001 molar up to 0.08 molar of sodium acetate in hydroponic culture solution were supplied to groups of 110 to 130-day-old *Digitalis* plants. Concentrations of sodium acetate below 0.001 molar were found to produce no inhibitory growth effects. From a comparison of the toxic effects produced by sodium, potassium, and lithium cations of acetate on *Digitalis*, lithium acetate was

found to produce the most severe inhibitory growth effects. No significant effects were observed on glycoside production by all concentrations of sodium and potassium acetates used. However, lithium acetate in the two concentrations employed (0.01 molar and 0.04 molar) resulted in a slight decrease in glycoside production in the leaves.

Isotope tracer technique was employed in order to examine the incorporation of acetate carbon by the *Digitalis* glycosides. Radioactivity measurements of *Digitalis* plants following feedings with carboxyl carbon-14 labeled sodium acetate in a 12-hour period showed that root tissues accumulated acetate carbon-14 in significant amounts (about 10 per cent) as compared with the accumulation of carbon-14 by the leaves (about 0.17 per cent). In a 10-day growth period, carbon-14 in the leaf tissues did not exceed 1.8 per cent despite the decrease of root carbon-14 from 10 to 4.17 per cent over the same growth period. Significantly large amounts of acetate carbon-14 were lost by respiration during the feeding period.

During a comparison of the acetate carbon-14 uptake in living *Digitalis* leaves of different size and age, greatest accumulation of this carbon was found in small and newly formed leaves.

A chromatographic method was employed for the quantitative isolation of glycoside fractions. Approximately 0.13 per cent total amorphous glycosides were isolated from leaf material. This was found to be largely glycoside of the gitoxin type. Efforts to prepare crystalline pure glycosides from this material were unsuccessful. Carbon-14 from the acetate source was found to be present in the glycoside fraction of the leaves but in very small quantities, e.g. about 0.074 to 0.118 per cent of the total recovered radioactive carbon in the leaf material.

An aglycone fraction was separated from the gitoxin glycoside fraction and found to contain carbon-14 from the acetate feedings. However, the specific radioactivity of carbon of this aglycone fraction was significantly small.

It was concluded that under the conditions of this experiment an acetate pool might have been employed for the biosynthesis of the *Digitalis* steroid glycosides but if this is true, the pathway of acetate carboxyl carbon to the glycosides was an exceedingly indirect one.

105 pages. \$1.31. MicA54-2810

THE ISOLATION AND CHARACTERIZATION
OF SOME MUTANT STRAINS OF
CHLAMYDOMONAS REINHARDI DANGEARD

(Publication No. 9489)

Wilbur Thomas Ebersold, Ph. D.
Stanford University, 1954

The unicellular green alga, *Chlamydomonas*, possesses characteristics that make this organism ideal for studies in the fields of comparative biochemistry and comparative genetics. Hence, investigations

were begun in an effort to recover genetically useful growth-factor mutations.

Mutant strains were isolated and characterized by means of the techniques used in comparable studies of other microorganisms. The mutants most exhaustively examined included the following: one dependent upon an externally supplied source of arginine, citrulline, or ornithine; two with reduced amounts of chlorophyll; one dependent upon a source of reduced carbon for growth and pigment-deficient; one unable to grow on acetate medium in total darkness; and two that grew slowly under all conditions employed. Each appeared to be a single gene mutation that was inherited in simple Mendelian fashion.

In addition, the analysis of linkage data indicated (1) the presence of at least two linkage groups and (2) that crossing over occurred at the four-strand stage during meiosis. This interpretation was also presented by Franz Moewus on the basis of data obtained when *C. eugametos* zygotes were germinated at room temperature. However, at temperatures below 5° C crossing over in *C. eugametos* occurred at the two-strand stage. In opposition to this finding, attempts to detect crossing over at the two-strand stage in *C. reinhardi* by subjecting zygotes to lowered temperatures were unsuccessful.

93 pages. \$1.16. MicA54-2811

STUDIES UPON THE VITAMIN REQUIREMENTS
OF LARVAE OF THE ONION MAGGOT
HYLEMYA ANTIQUA (MEIG.)
UNDER ASEPTIC CONDITIONS

(Publication No. 9748)

William George Friend, Ph. D.
Cornell University, 1954

Onion maggot larvae were reared individually in one dram shell vials under aseptic conditions on a chemically defined diet. The diet consisted of 19 L amino acids, 9 crystalline B vitamins, Coenzyme A, thioctic acid, inosine, thymine, ribonucleic acid, glucose, cholesterol, U.S.P. XIII number 2 salt mixture and agar. A series of 11 experimental diets were formulated to test the effects of individual deficiencies of each of the 9 B vitamins, coenzyme A and thioctic acid. A check diet which contained all of the vitamins listed above was made up. Another diet similar to the check diet but with the vitamin level raised 12.5 per cent was tested in conjunction with the vitamin deficient diets.

Daily observations were made to check the development rate of the larvae on each diet. The development rates of larvae on the deficient diets and on the high vitamin level diet were compared with the development rate of larvae on the check diet.

Seventy per cent of the larvae on the check diet reached the adult stage. Lack of biotin caused 88 per cent of the larvae on the minus biotin diet to die before reaching the third instar. None of the surviving larvae lived to form pupae.

Lack of vitamin B₁₂ caused slightly higher mortality at all stages of development than occurred on the check diet which contained this factor. Only 46.6 per cent of the B₁₂ deficient larvae became adults. Female onion maggot larvae seem to need B₁₂ more than the males.

Omitting pantothenic acid from the diet caused 95.5 per cent of the larvae on this diet to die before reaching the third instar. None of the larvae lacking pantothenic acid lived to form pupae.

Lack of choline affected the larvae as they tried to pupate; 79.6 per cent of the larvae on the choline-free diet reached the third instar but none could pupate.

Lack of folic acid also affected the larvae as they tried to pupate; 80.6 per cent of the larvae on the folic acid-free diet reached the third instar but only 2.8 per cent, one larva of 36, pupated. This larva died in the pupal stage.

When either pyridoxine or riboflavin were omitted from the diet the larvae all died before reaching the third instar.

Only one larva of 42 reached the third instar on the nicotinic acid-free diet. This larva died before pupating.

Slightly higher mortality at all stages of development resulted when coenzyme A was omitted from the diet. Female mortality was higher on the coenzyme A -free diet.

Omitting thioctic acid from the diet caused higher mortality than was recorded on the check diet; 50.1 per cent of the larvae on the thioctic acid-free diet formed adults.

Larvae on the thiamin-free diet did not develop normally; 97.5 per cent died before reaching the third instar. All the larvae on this diet died before pupation.

Raising the level of the 11 vitamins or growth factors used in the check diet by 12.5 per cent causes a significant improvement in larval development. On the high vitamin level diet 87.9 per cent of the larvae formed adults whereas only 70 per cent of the larvae on the lower vitamin check diet reached this stage of development.

Of the 11 vitamins or growth factors tested, biotin, pantothenic acid, choline, folic acid, pyridoxine, riboflavin, niacin and thiamine are essential for the growth and development of *H. antiqua* larvae grown under aseptic conditions. The addition of vitamin B₁₂, thioctic acid and coenzyme A to the diet improves development slightly but these compounds are not essential nutrients for the insect under the experimental conditions.

This is believed to be the first chemically defined diet developed which will support the growth and development of a phytophagous insect living under aseptic conditions.

36 pages. \$1.00. MicA54-2812

RELATIONSHIPS OF THE AVIAN FAMILY FRINGILLIDAE

(Publication No. 9555)

Gideon Edmund Nelson, Jr., Ph. D.
University of Florida, 1954

Species of the Families Fringillidae, Ploceidae, and Thraupidae were compared osteologically. On the basis of proportions and features of the skeleton, the following changes were proposed in the classification of the Family Fringillidae:

1. The Family Ploceidae was placed in the Family Fringillidae as the Subfamily Ploceinae.

2. The Subfamily Richmondinae was transferred to the Family Thraupidae. The richmondine genera, *Gubernatrix*, *Paroaria*, *Porphyrospiza*, *Tiaris*, and *Spiza* were placed in the Subfamily Emberizinae.

3. The cardueline genera *Loxia*, *Sporophila*, *Oryzoborus*, *Volatinia*, and *Sicalis* were transferred to the Subfamily Emberizinae.

4. Members of the Subfamily Geospizinae were placed in the Emberizinae.

5. The following generic changes were made in the Subfamily Emberizinae: *Pooecetes* transferred to the genus *Ammodramus*; *Passerherbulus* to the genus *Passerculus*; *Aimophila ruficauda* and *A. rufescens* to *Pipilo*; *Melospiza melodia* to *Passerella*; *Melospiza georgiana*, *Ammodramus caudacuta*, *A. nigrescens*, and *A. maritima* to the genus *Helo-spiza*.

A diagnosis was presented for the families and subfamilies as well as a suggested phylogeny for the entire assemblage.

110 pages. \$1.38. MicA54-2813

DIMORPHISM OF FRUIT FORM IN BUTTERNUT SQUASH, CUCURBITA MOSCHATA DUCH.

(Publication No. 9770)

Edward William Owens, Ph. D.
Cornell University, 1954

Dimorphism of fruit form occurs in the Butternut variety of *Cucurbita moschata* Duch. Such dimorphic plants bear, in the apical regions, fruits much resembling the elongate fruits of certain Cushaw varieties and particularly those of the Winter Crookneck variety. Short fruits of the Butternut type are produced in the basal regions. Associated with dimorphic plants in the Butternut variety are plants which produce only Crookneck type fruits. Plant breeders working with Butternut have not been successful in completely eliminating these aberrant types from the variety. The appearance of dimorphic plants together with isomorphic Crookneck types was suggestive of somatic mutation occurring in heterozygous plants resulting in the appearance of a homozygous recessive Crookneck phenotype. However, the lack of apparent sectorial chimeras, the absence of independent

mutations on the lateral branches without involvement of the main stem, and the general apical — basal system in dimorphic plants appeared to indicate that a physiological system might also be involved.

Selves within two dimorphic plants have indicated the existence of true genetic differences within the dimorphic plants, indicating a mutational event.

Crosses between Butternut and a non-segregating strain of Winter-Crookneck showed segregation for Butternut and Crookneck classes only; however, the Butternut class showed a much increased degree of dimorphism as compared to that observed in the Butternut parent. Segregation was observed in F_1 , F_2 and in backcrosses of the F_1 to the Butternut parent. A cross of a Crookneck clone of a dimorphic plant to Butternut resembled in performance the F_1 's of Butternut X Winter Crookneck. The self of this Crookneck clone showed no segregation, all plants being Crookneck in type. The breeding behavior of Butternut areas of dimorphic plants was not ascertained since it appeared that clones needed to be used to eliminate possible physiological effects on fruit shape. Attempts early in the study to establish Butternut type clones failed due to the reversion of such clones to the Crookneck type.

Crosses of Butternut to four inbred lines of Golden Cushaw indicate polygenic differences in the inheritance of fruit form in these varieties. However, there appeared to be some segregation in the F_1 with some Butternut shapes being present. Dimorphic plants were present only in segregating generations and then in small numbers suggesting recombination of Butternut genes for fruit form.

It was not possible to demonstrate the existence of a phenotype associated with mutable or potentially mutable Butternut plants.

Graftage experiments with Butternut and Crookneck clones of dimorphic plants do not indicate the presence of any transmissible substance which might effect a change from Butternut to Crookneck type in the fruits. Injection of aqueous solutions of auxin in amounts up to 2500 micrograms into the apical regions of both Butternut and Crookneck clones of dimorphic plants had no effect on fruit form and at the highest concentrations only slight effect on plant growth.

Differential nitrogen fertilization in the field had no effect on the numbers of Butternut, dimorphic or Crookneck type plants occurring in segregating populations. Planting early and late with a resultant 10^0 F. increase in mean temperature during germination of the late planted seed resulted in a decrease of the Crookneck class in two segregating populations as compared with the earlier planting. Physiological conditions are not believed to promote the expression of dimorphism. However, environmental conditions may influence the apparent mutation rate.

It is postulated that the mutability of Butternut may be under control by a gene or genes not at the affected locus. However, such a system has not been adequately demonstrated and the presumption may be due to the difficulty of observing all possible events. Thus, it may be concluded only that dimorphism is

due to mutation at an unstable locus with or without control by other autonomous genes.

Limited experiments with X-ray do not indicate pronounced sensitivity of the unstable locus to ionizing radiation. Dosage tolerances for this material were established to be 15,000 r for seed and 4,000 r for succulent tissue.

Because Butternut and Winter Crookneck appear to differ in fruit form chiefly by a single gene difference it is concluded that the latter or a closely related variety is the parental variety of Butternut.

It is proposed that a practical solution to the difficulties encountered in producing non-mutating strains of Butternut lies in transferring genes for fruit form to the Butternut genome from other short-fruited Cushaw varieties, which have not been observed to mutate.

75 pages. \$1.00. MicA54-2814

HETEROSIS IN TOMATOES AS AFFECTED BY DIVERSE ORIGIN OF PARENTS

(Publication No. 9621)

Ferdinand Antonio Quiñones, Ph. D.
University of Minnesota, 1954

Adviser: T. M. Currence

It was thought that the diverse parentage of certain varieties of tomatoes resulting from crosses to different wild species might give a diversity of genes that would be of value in obtaining a greater degree of heterosis than that obtained from crosses within the *Lycopersicon esculentum* species. Accordingly four groups of varieties to be used in crosses were chosen on the basis of the different species or combination of species that appear in their parentage.

One group was composed of the varieties Firesteel, Pritchard and Rutgers which have only *L. esculentum* in their recorded pedigree. A second group was made up of the varieties Pan America, Southland, Pearl Harbor and Wisconsin 55. *L. pimpinellifolium* is found either in their immediate or in their distant pedigree. The third group was made up of High C and New Hampshire #50. These were obtained from a cross between *L. esculentum* and *L. peruvianum*. Group four consists of three varieties Lanai, Maui and Hawaii. Pedigrees of these varieties contain the three species, *esculentum*, *pimpinellifolium* and *peruvianum*.

Fifty two F_1 crosses and 12 parents were tested in a triple lattice field experiment. In order to determine if, as an average, diversity of origin affected the performance of hybrids the data were divided into three classes. These were the four parental groups or 12 varieties selfed, the ten crosses within parental groups, and the 42 crosses between parental groups. Total yield, early yield, grade one fruit yield and fruit size were studied. Heterosis was studied in terms of performance of hybrids in tons per acre or fruit size in ounces, and also in terms of percentages

of increase of the individual hybrids over the higher parent and over the average of the parents.

Crosses within parental groups did not differ significantly from the crosses between parental groups for any of the four characters. Total yield was the only character that showed a slight tendency to have a higher average heterosis for the crosses between parental groups. It can be concluded that, in general, origin of parents as determined in this experiment does not greatly affect heterosis. These results differ from those of Powers with tomatoes and from the various studies reported on single crosses between genetically diverse corn inbreds.

A possible explanation is that the varieties in parental groups II, III and IV probably are not as genetically different from those of group I or from those of each other as the presence of various species in their parentage might suggest. It is possible that several backcrosses to the *esculentum* parent or successive crosses to other *esculentum* varieties which followed the original cross with the wild species in each one of the varieties in groups II, III and IV, were effective in eliminating certain wild species genes affecting heterosis. If this were the case, genetic diversity between the varieties used in this study might be rather limited. Consequently, no increased heterosis due to genetic diversity would be expected. Some of the *esculentum*-*pimpinellifolium* inbreds that Powers used were backcrossed only once and others not at all. This might explain why Powers obtained increased heterosis by crossing inbreds of diverse origin.

No definite increase in heterosis could be obtained in favor of either the related or unrelated crosses in this experiment. Unrelated crosses were obtained from varieties having no immediate parents in common and without regard for the species in their pedigrees.

120 pages. \$1.50. MicA54-2815

PHYSIOLOGIC SPECIALIZATION AND
THE NATURE OF PARASITISM IN
COLLETOTRICHUM LINICOLUM
PETHYB. & LAFF.

(Publication No. 10,041)

Erwin Schwinghamer, Ph. D.
University of Minnesota, 1954

Adviser: J. J. Christensen

This study was undertaken to determine whether distinct pathogenic races occur in the flax anthracnose pathogen, *Colletotrichum linicolum* Pethyb. & Laff., and to obtain information on the nature of parasitism in contrasting varietal reaction types.

The isolates of *Colletotrichum linicolum* used in the study comprised many cultural types, some of which were cultural variants. The latter were usually accompanied by a loss in virulence.

The cardinal temperatures for the growth of two

isolates of *Colletotrichum linicolum* on six different artificial media were approximately 4°, 27° and 36°C. Similarly, the optimum soil temperature for damping-off of flax seedlings was 25°-30°C., but the differential response between varieties was most pronounced at a sub-optimum temperature of about 15°C.

Inoculation of flax seedlings in the cotyledon stage with a spore suspension provided the simplest and most selective method of testing isolates for pathogenicity. The most accurate results were obtained with a spore concentration of approximately 150 spores per cu. mm., a 24-hour exposure to high humidity and a temperature of 60°F. In general, age of the plants did not affect the disease reaction.

Commercial varieties of flax grown in the United States, with the exception of Crystal, proved unsatisfactory for differentiating pathogenic races. In a screening test of approximately 650 entries of the world collection of flax the following six varieties, representing different levels of resistance, were selected as differentials: Punjab, Ottawa 770B, Leona, C.I. 1016, C.I.1235 and C.I. 1247. By means of these differentials it was possible to separate 42 monoklonal isolates of *Colletotrichum linicolum* into five distinct pathogenic race-groups.

Abnormalities in spore germination, appressoria formation and cellophane membrane penetration were associated with ability to parasitize flax only in weakly pathogenic isolates. Such isolates produced only odd-shaped "pseudo-appressoria" or did not form appressoria at all. Virulent isolates generally produced appressoria and did not differ significantly in ability to penetrate membranes.

Penetration was accomplished by an appressorial infection peg which was clearly visible in membrane cross-sections. In a susceptible host reaction this peg entered the epidermal cell and enlarged apically to form a balloon-shaped vesicle which subsequently branched to become the multi-lobed primary hypha. The lobes then attenuated to form the secondary hyphae which entered the mesophyll. In the highly resistant type represented by Leona the appressoria were unable to penetrate the epidermal cells. Beneath some appressoria there was no visible reaction; beneath others appeared only a cone-shaped bulge which was interpreted as a cytoplasmic membrane indentation by the peg. The resistant reaction of C.I. 1235 was similar to that of Leona, except that the former variety contained many individual necrotic cells in which the growth of the fungus had been completely checked in the primary hyphal stage. A still wider range in disease reactions was noted on cotyledons of Ottawa 770B and C.I. 1016. This range included non-penetrated cells, single necrotic cells and groups of semi-necrotic cells from which hyphal growth spread to form lesions of varying size.

Of the commercial varieties inoculated in the seedling stage only Crystal, Sheyenne, B5128 and Redwing had varying degrees of resistance to isolates representing three race-groups of *Colletotrichum linicolum*, while all varieties were susceptible to isolates of the other two race-groups. When the plants were inoculated in the boll stage the evaluation of varietal resistance to seed infection was best

accomplished by planting the harvested seed in steamed soil and determining the percentage of seedlings with lesions on the cotyledons. The varieties B5128, Crystal, Redwood, Redwing, Sheyenne, Biwing and Minerva were relatively resistant to seed infection. 101 pages. \$1.26. MicA54-2816

THE INHERITANCE OF PATHOGENICITY
AND CERTAIN OTHER CHARACTERS IN
VENTURIA INAEQUALIS (CKE.) WINT.

(Publication No. 9904)

Edwin Bruce Williams, Ph. D.
Purdue University, 1954

Major Professor: J. R. Shay

The inheritance of the genes for pathogenicity which differentiate three physiologic races of the apple scab pathogen, *Venturia inaequalis* (Cke.) Wint., was investigated. Race 2 of the fungus differs from Race 1 (the commonly occurring strain) in its ability to attack *Malus baccata* var. Dolgo and certain segregates of a Russian apple, *M. pumila* R12740-7A, Race 3 differs from Race 1 in its ability to attack *M. pumila niedzwetzkyana* var. Geneva. It was found that all three unusual pathogenic reactions were controlled by three different genes designated as *dolgo* (*d*⁺), *russian* (*r*⁺), *geneva* (*g*⁺).

The linkage relationships of these genes were studied with respect to each other, with the centromeres, and with known genes, *green* (*gr*), *mating type* (*mt*⁺), and *sikkless* (*s*). The gene, *green*, controls green mycelial color; *mating type* controls development of asci; and *sikkless* controls a reduced virulence reaction (pinpoint pits) on *M. sikkimensis*.

In addition to these genes, another gene, *sikkless*'

(*s*[']), was identified in the green parental stock. This gene is phenotypically identical with *sikkless* but is probably not allelic.

The study was conducted by mating fungus strains *in vitro*; isolating ascospores, in serial order, from hybrid asci; and determining genotypes by cultural methods or by host inoculations under controlled greenhouse conditions. A total of 294 hybrid asci were classified for pathogenic reaction on one or more of host selections, Dolgo, R12740-7A, Geneva, and *M. sikkimensis*.

Data on second division segregation of genes indicate that all are located at considerable distances from the centromeres. *Sikkless* was located at 22.8 crossover units from the centromere; *geneva* was located at 31.3 units; and *mating type* at 31.9 units. All distances are uncorrected for double crossovers and must be considered tentative. The remaining four genes, *dolgo*, *russian*, *green*, and *sikkless*', were too far from the centromere to be located by the second division segregation method.

Three genes, *s*, *d*⁺, and *r*⁺, were found to be linked in that order with *s* being nearest to the centromere. Data on recombination of genes indicate that *s* and *d*⁺ are 25.0 crossover units apart, and that *d*⁺ and *r*⁺ are 9.7 crossover units apart. These distances are uncorrected for double crossovers. The remaining genes, *g*⁺, *s*['], *gr*, and *mt*⁺, were found to be inherited independently of each other and of the three linked genes.

Non-random orientation of the ascospores in the ascus and nuclear passage in the four nucleate stage were not considered factors of importance in this study.

With respect to pathogenicity five new recombinant strains of the following genotypes were obtained: *d*⁺*r*⁺*g*⁺, *d*⁺*r* *g*⁺, *d* *r*⁺*g*⁺, *d*⁺*r* *g*, and *d* *r*⁺*g*. Fourteen isolates of the strain, *d*⁺*r*⁺*g*⁺, were tested on twenty-two host selections representing eight sources of resistance in *Malus*. No evidence of interaction among the genes to give a new infection result was observed.

93 pages. \$1.16. MicA54-2817

BOTANY

THE MEDULLOSAE —
STRUCTURE AND RELATIONSHIPS

(Publication No. 9063)

Theodore Delevoryas, Ph. D.
University of Illinois, 1954

The method employed in this study of the genus *Medullosa* involved the collection and examination of as many specimens as possible in order to determine the structure of these stems, including changes in anatomy due to increasing age. It was thus possible to observe the sequence of development of stems of *M. Noei* from a level just below the apex, to an old

stage which is typified by an abundance of secondary vascular tissue, secondary parenchyma, and an absence of leaf bases which were sloughed off as the stem expanded in diameter. The specimens formerly called *M. distelica* and *M. pandurata* are nothing other than growth stages of *M. Noei*, but were fossilized at an earlier period in ontogeny than the holotype of that species.

Medullosa Noei is essentially a three-steled species (stelar number ranges from 2-4). Although cylinders of secondary parenchyma which are very common in old stages of that species were previously considered to be homologous with steles, they are actually the results of localized proliferation of

parenchyma cells in the primary xylem, vascular rays, or ground tissue. The structure of these groups of secondary parenchyma cells resembles closely the thick outer layer of periderm in old stems. The steles in this species appear to have undergone a tangential expansion during ontogeny, accomplished primarily by a continuation of the activity of the procambium-like xylem parenchyma even after the initiation of secondary development.

A somewhat similar growth sequence can be shown to have occurred in *M. primaeva* since a large number of specimens examined present a closely intergrading series from a portion of a stem near the apex, to a very nearly basal segment. *M. primaeva* differs from *M. Noei* in rather great degree of variability of stelar number in the stem, with extremes of two and twenty-three having been observed. Since leaf traces of *M. primaeva* may or may not possess secondary vascular elements, it has become necessary to consider *M. heterostelica*, *M. grandis*, *M. elongata*, and some specimens of *M. Thompsonii* and *M. distelica* as synonyms of *M. primaeva*.

Since this study reveals the changes which occurred in *Medullosa* stems during the ontogeny of the plants, it is now possible to interpret isolated fragments of other species somewhat more accurately than was previously possible. Five species and one variety have been recognized from North America (although additional material of some of these taxa may necessitate a revision). These forms are: *M. Noei*, *M. anglica* var. *Thiessenii*, *M. Thompsonii*, *M. primaeva*, *M. endocentrica*, and *M. Olseniae*.

Certain evolutionary trends have been detected within the medullosae which give some indication of the origin of the Medullosaceae, and suggest two main lines within the family. These forms appear to have arisen from a many-steled progenitor in which stelar dichotomies were common. Leaves and stem axes were supposedly identical in such an assumed primitive form. A gradual phyletic fusion of the steles, accompanied by a loss of secondary elements in leaf traces, resulted in the few-steled Carboniferous types. The other trend, initiated in the many-steled types, involved a phyletic fusion, in a tangential direction, of the tangentially expanded peripheral steles, with a gradual decrease in size of the innermost ones. From the Permian types which are considered the result of the second tendency, the gap to the anatomical condition of present-day cycads is very small. *Colpoxylon*, also in the Medullosaceae, represents a type having much in common anatomically with the cycads, while *Sutcliffia*, the third stem genus of the family, shows a primitive internal structure typified by prolific stelar dichotomy.

171 pages. \$2.14. MicA54-2818

RELATIONSHIPS IN THE CAPILLARIA GROUP OF PANICUM

(Publication No. 9913)

David Earl Fairbrothers, Ph. D.
Cornell University, 1954

Data from studies of the gross morphological, ecological (physiological) and cytological variation and geographical distributions indicate relationships for the species assigned to the *Capillaria* group of *Panicum*. Except for the three species (*cayennense*, *parcum*, *decolorans*) which do not occur in the United States, data are derived primarily from living specimens.

The basic number of chromosomes for the group is nine. The somatic number of chromosomes is eighteen in *P. hirticaule*, *P. hillmani*, *P. flexile*, *P. capillare*, *P. lithophilum* and the three subspecies of *P. philadelphicum*. *P. stramineum*, $2N = 36$, and *P. miliaceum*, $2N = 49+$, are the only species with a polyploid number of chromosomes.

The geographical distribution of this group ranges from southern Canada to central South America. One species occurs in the Old World.

Data from garden and greenhouse samples of *P. stramineum*, *P. miliaceum*, *P. hillmani*, *P. flexile*, *P. capillare*, *P. lithophilum* and the three subspecies of *P. philadelphicum* reveal that several of the vegetative characteristics (diameter of culms, width of blades, exsertion of panicles, leafiness of culms, orientation of panicle branches) are usually too variable to be used as key characteristics.

Most measurements of vegetative characteristics from garden and greenhouse plants exceed measurements from wild plants. However, the statistical ranges for the same characteristics usually are less for the cultivated than for the wild plants.

The following species and subspecies are recognized in the *Capillaria* group. *P. cayennense* is the most primitive species, and *P. lithophilum* the most advanced.

1. *P. cayennense*
2. *P. parcum*
3. *P. decolorans*
4. *P. hirticaule* (including *P. pampinosum* and *P. sonorum*)
5. *P. stramineum*
6. *P. miliaceum*
7. *P. hillmani*
8. *P. flexile*
9. *P. capillare* (including *P. barbipulvinatum* and *P. capillare* var. *occidentale*)
10. *P. philadelphicum*
 ssp. *philadelphicum* (= *P. philadelphicum*)
 (new combination)
 ssp. *campestre* (= *P. gattingeri*) (new combination)
 ssp. *tuckermani* (= *P. tuckermani*) (new combination)
11. *P. lithophilum*

Results from this study indicate that possibly several types of isolating mechanisms have been

important in the evolution and speciation of this group. The isolating mechanisms are genetical barriers (*hillmani* and *capillare*, *capillare* and *hirticaule*), ecological or physiological resulting from mutation and natural selection (subspecies of *philadelphicum*), geographical (Mexican and Central American species from some of the United States species, southwestern United States species from eastern United States species), and possibly chromosomal (*stramineum*). Some of the species seemingly display a combination of two or more of the above-mentioned mechanisms. The contribution that will be made by putative hybrids for the three subspecies of *P. philadelphicum* is at the present time unknown. These subspecies are the only taxa where index values, scatter diagrams and histograms reveal extensive hybridization.

The data also provide a basis for establishing a more natural grouping and reduction in the number of recognized species in the *Capillaria* group.

147 pages. \$1.84. MicA54-2819

HISTOLOGICAL STUDY OF SUSCEPT-PATHOGEN RELATIONSHIPS BETWEEN *SOLANUM DEMISSUM* LINDL. DERIVATIVES AND *PHYTOPHTHORA INFESTANS* (MONT.) deBARY

(Publication No. 9746)

Virginia Rogers Ferris, Ph. D.
Cornell University, 1954

Histological studies were made of the interactions between leaf tissue of the Irish potato (*Solanum tuberosum* L.) and *Phytophthora infestans* (Mont.) deBary, the organism which causes the disease known as late blight. Potato varieties used were progeny of crosses between *S. tuberosum*, susceptible to late blight, and *Solanum demissum* Lindl., which contains several genes for resistance to the disease. With respect to resistance, these potato varieties were of several different genotypes. Several races of the pathogen, which differ in their pathogenicity to these genotypes, were used. The techniques for inoculation and incubation were standardized, and all plants were maintained at 18°C. following inoculation. The histological observations were made on sectioned material and on cleared whole leaves.

In most of the susceptible plants, hyphae were found in mesophyll tissue distant to the site of penetration 17 to 20 hours following inoculation. In all susceptible plants such hyphae were found 26 to 28 hours after inoculation. In the genotypes giving a resistant reaction, short secondary hyphae were often seen between mesophyll cells near the site of penetration, but widely ramifying mycelium was never observed.

In most of the plants giving a resistant reaction to the pathogen, a necrotic response developed a few hours before such a response was evident in susceptible plants. This response included a thickening of the walls of the penetrated epidermal cell, followed by a browning of the cell. If secondary hyphae formed,

mesophyll cells near these hyphae also became brown. Differences among the varieties were noted in the rapidity with which a necrotic response developed.

The necrotic lesions in resistant and susceptible plants often had a similar appearance 42 to 49 hours following inoculation. Nearly the same number of cells made up the lesions, and the mesophyll cells appeared to be responding to about the same degree. Mycelium could, however, be followed away from the lesions in the susceptible plants. Often small groups of cells near a primary lesion, in contact with the mycelium, were beginning to brown slightly. No ramification of the mycelium was observed in resistant plants, and the lesions remained confined to the small area which had responded within the first 26 to 28 hours following inoculation.

The reactions to the pathogen of two varieties of potatoes, each believed to have a gene for resistance in the duplex condition, were investigated. Duplex plants were inoculated with races pathogenic to plants simplex for the same gene. The macroscopic symptoms on these plants, four days following inoculation, resembled those usually found on resistant plants. Histological examination, however, of leaflets taken 42 to 49 hours following inoculation revealed that the lesions were different in appearance from those found at this time interval on any of the leaflets previously examined, whether resistant or susceptible. The response in the duplex plants was comparable to that of a susceptible simplex plant after 26 to 28 hours following inoculation. A susceptible reaction was obtained in the duplex plant when a culture reisolated after serial passages through a plant of the same genotype was used as the inoculum.

72 pages. \$1.00. MicA54-2820

TAXONOMY OF THE GENUS *HELIOPSIS* (COMPOSITAE)

(Publication No. 10,143)

Tharl Richard Fisher, Ph. D.
Indiana University, 1954

Chairman: Dr. Charles B. Heiser, Jr.

The genus *Heliopsis* (family Compositae, tribe Heliantheae) is composed of thirteen species, ranging from eastern United States and southern Canada west to the Rocky Mountains, south through Mexico, Central America and to central Bolivia.

There has been a great deal of confusion in regard to the status of several taxa of the genus. The purpose of this investigation was to study the genus throughout its entire range in order to gain information concerning the relationships of the species of the genus. The problem was attacked in three ways: by a study of available herbarium material, by growing and studying as many races as possible in the research garden, and by studying natural populations. These techniques involved conducting a hybridization

program, a cytological study, and an investigation of the ecological conditions throughout the range of the species. The biosystematic treatment was limited to the species of the United States.

Thirteen species are recognized in the present treatment, one of which, *H. brachactis*, is described for the first time. The *H. helianthoides* complex of the United States is interpreted as being composed of three subspecies. Taxonomic keys, descriptions and distribution maps are given for all species.

Four species, *H. parvifolia*, *H. rubra*, and *H. annua* of Mexico, and *H. helianthoides* of the United States, were found to possess a chromosome complement of $n = 14$.

Hybrids between *H. rubra* and *H. parvifolia* were found to be sterile and hybrids between *H. parvifolia* and *H. helianthoides* exhibited a great reduction in fertility. *Heliopsis rubra* on the other hand failed to cross with *H. helianthoides*. There are apparently no reproductive barriers to crossing within the *H. helianthoides* complex. Hybrids have been easily made between the subspecies and are almost as fertile as the parental types.

The hybrid between *H. helianthoides* subsp. *helianthoides* and *H. parvifolia* resembles *H. helianthoides* subsp. *scabra* very closely. It seems possible that subsp. *scabra* may owe its origin to hybridization of these taxa sometime in its evolutionary history.

The overall pattern of variation in the *H. helianthoides* complex is vast and multi-dimensional. The petiole length, leaf base angle, peduncle length, head width and pubescence were studied in connection with the variation problem of *H. helianthoides*. Data for these characters were assembled from 2,000 herbarium specimens borrowed from the major herbaria in the United States. Morphologically the three subspecies, *H. helianthoides* subsp. *helianthoides*, subsp. *occidentalis* and subsp. *scabra* are quite distinct within their centers of distribution. From a quadrat study of herbarium material it is evident that subsp. *helianthoides* and subsp. *occidentalis* are connected by a broad band of intermediates, covering an area of several hundred miles. There is only slight intergradation of characters between subsp. *occidentalis* and subsp. *scabra* and none between subsp. *helianthoides* and subsp. *scabra*.

Two hypotheses are proposed to account for the variation pattern found to exist in *H. helianthoides*. First, natural selection alone may be considered as a possible explanation of the character gradients or clines. Secondly, extensive hybridization with repeated backcrossing where the ranges of the taxa overlap also seems likely on the basis of the present data.

197 pages. \$2.46. MicA54-2821

INHERITANCE OF RESISTANCE TO SYSTEMIC TOBACCO MOSAIC INFECTION IN PEPPER

(Publication No. 9188)

Dallas Denver Lutes, Ph. D.
University of Missouri, 1954

All tested varieties and experimental lines of red pepper, *Capsicum frutescens* L., show some degree of infection when inoculated with common tobacco mosaic virus. In the present study, external symptomatology of four different reaction types was thoroughly examined. The general effect of each type on infected plants is as follows: (1) Localized necrosis, characterized by local infection with small chlorotic lesions formed near the infection site, usually on a leaf, followed by necrosis and dropping of infected leaves without systemic virus spread; (2) systemic chlorosis, characterized by systemic infection of foliage and fruit with chlorotic lesions formed and followed by mottling; (3) delayed necrosis, characterized by systemic infection of the systemic chlorosis type with small necrotic lesions formed on the main stem; and (4) systemic necrosis, characterized by systemic infection with large dark necrotic lesions on the main stem. Normal growth and fruit yield are reduced in plants showing systemic infection.

Holmes had reported earlier the four reaction types and concluded that three factors, members of a multiple allele series, were responsible for the different reactions. The *L* factor was shown to be completely dominant over the other two and *li* incompletely dominant over *l*. All individuals with the following genetic constitutions, *LL*, *Llⁱ*, *Ll*, showed localized necrosis; *liⁱli*, showed delayed necrosis; *ll*, showed systemic chlorosis; and *liⁱl*, showed systemic necrosis.

Separate crossing and selfing tests were made to determine the genetic constitution and derivation of a single uninfected California Wonder plant found in a field of heavily virus infected plants of this variety in Southwest Missouri. *F₁* progeny obtained by planting seed from this plant gave the phenotypic infection ratio of three localized necrosis: one systemic necrosis. Results from inoculated progeny of crosses between *F₁* individuals indicated the genetic constitution of these plants to be *LL*, *Llⁱ*, *Ll* and *liⁱl*. From other experimental crosses, which involved *F₁* progeny of this type and pure line pepper varieties California Wonder and Long Red Cayenne and three experimental lines obtained from New Jersey, it was indicated that the original plant was probably derived through chance hybridization.

Resistance to tobacco mosaic virus is determined by the ability of the individual plant to completely localize the virus. A breeding program was started for the development of virus resistant peppers for commercial use in Missouri by crossing plants homozygous for localized necrosis which lacked ideal growth and fruit characters with *F₁* progeny from the hybrid plant described above which possessed the desired characters. Selections from these crosses were compared with variety California Wonder in regard to rate and percent of seed germination, initial

growth rate, earliness of flowering and fruiting, quality of fruit and quantity of fruit.

From 100 hybrid and backcross lines which were carried through the F_6 generation in field tests, only two selections were considered as promising commercial lines. Progeny from the selections showed complete resistance to systemic virus infection and at the same time were superior to California Wonder in rate and percent of seed germination, initial growth rate and earliness of flowering and fruiting; equal to this variety in quality of fruit and slightly inferior in fruit quantity. The selections have been allowed to segregate through only two generations and further segregation is recommended before seed can be distributed for commercial purposes.

107 pages. \$1.34. MicA54-2822

STUDIES OF THE RINGSPOT VIRUS COMPLEX IN SWEET CHERRY

(Publication No. 9192)

Daniel Franklin Millikan, Jr., Ph. D.
University of Missouri, 1954

Studies of the ring spot complex in sweet cherry involving symptomology, growth and the biochemical aspects of the nucleo-protein associated with infection have been completed. Inoculation studies indicated that sweet cherry varieties fall into two groups as regards to ring spot infection. One group, represented by the Lambert and Napoleon varieties, is very sensitive to ring spot infection showing necrosis varying from the killing of a few spurs to complete killing of the varietal tissue to the understock. The less sensitive group including Gold and Hardy Giant, shows the usual symptoms of chlorotic spotting that may or may not become necrotic. The extensiveness of the necrosis in the sensitive varieties suggests a variance in virulence which seems to be due to the ring spot component, whether the entity appears alone or as a component in the virus culture.

Regional isolates of ring spot or yellows differ from each other no more than do isolates collected from the same region. Furthermore, ring spot strains collected from different hosts when inoculated into the same host produce symptoms so similar that there seems to be little reason for considering them as belonging to different virus groups. On the other hand, the latent virus group does not appear to be very closely related to the necrotic ring spot strains. Not only are these viruses symptomless on sweet cherry, but they will not confer protection against subsequent infection with the more virulent necrotic ring spot strains.

Growth studies made over a three year period demonstrated that a factor significantly reducing the growth of one year-old nursery trees was present in cherry stocks propagated from non-indexed sources and trees artificially infected with the ring spot virus. This growth inhibition appears to be restricted to the middle part of the growing season. It is not ap-

parent during the first two months of the growing season and is not significant during the last two months. The possibility that this factor could be ring spot is shown and emphasizes the urgency to eradicate this disease.

A procedure to extract the nucleic acids from cherry leaves is described. Tests on diseased and disease-free material indicate that there is approximately 50 per cent more ribose nucleic acid in ring spot infected leaves than in disease-free leaves. This suggests that the nucleo-protein associated with ring spot is of the ribose type. Differences in the nucleic acid content between the various strains of the virus used in the study could not be detected.

151 pages. \$1.89. MicA54-2823

THE FOLIAGE AS A SOURCE OF SECONDARY INOCULUM FOR TOMATO ANTHRACNOSE AND THE NON-SPECIFICITY OF THE CAUSAL ORGANISMS

(Publication No. 9771)

Maria Emmanuel Pantidou, Ph. D.
Cornell University, 1954

Tomato anthracnose caused by the fungus *Colletotrichum phomoides* (Sacc.) Chester is recognized as the major disease of tomato in New York State. Control of the disease is not considered satisfactory despite considerable advances made through the use of the organic fungicides. A better understanding of the nature of the disease appeared necessary.

It has been assumed that the causal agent overwinters in the soil or soil debris and that primary infections from this source constitute the major factor in pathogenicity throughout the growing season. This idea is based largely on circumstantial evidence and little experimentation. The present study was undertaken in an attempt to clarify some of the imperfectly understood aspects of the disease. In addition, problems on the specificity of the pathogen were investigated.

It was found early in this investigation that leaves from tomato plants harbor *Colletotrichum* spores capable of producing anthracnose when inoculated to tomato fruits. The possibility of the origin of such spores by growth of the fungus through the roots up to stems and leaves was eliminated as a result of a series of root inoculation experiments conducted. It appeared however, that the fungus can grow into the roots and the lower part of the stem and thus offer to itself a safer means of overwintering. It also appeared that there is a variation in the ability of different isolates to grow into the roots and stems of the tomato plant.

Foliage infections reported previously by other investigators were confirmed by penetration and infection experiments. It was demonstrated that not only *C. phomoides*, but other anthracnose-causing fungi as the apple organism *Glomerella cingulata*,

can cause primary infections on tomato foliage. It was also demonstrated that senescent leaf tissue or tissue killed by *Alternaria* or flea beetles provide the most favorable medium for growth and sporulation of such fungi. The longer the post-inoculation exposure to moisture the higher was the sporulation of the fungus.

Under natural field conditions the tomato foliage was found to harbor *Colletotrichum* spores. Anthracnose developed in all cases when filtrates from field leaves were sprayed on healthy detached tomato fruits. *Colletotrichum* growth was obtained on potato dextrose agar plates from flea beetle lesions of leaves picked from field plants and cultured.

Such findings indicate that foliage infections might play an important role in the spread of the disease in the field. Direct evidence for this was provided in 3 successive greenhouse experiments. Transmission of the fungus from the infected foliage to fruits grown in the same plant was achieved. The tomato plants were grown under carefully controlled conditions to prevent contamination from external sources. They were inoculated when young and before any bloom. Three months later developing fruits were allowed to touch the infected foliage. A high percentage of the fruits became infected in 6 to 14 days and developed large anthracnose lesions. It was shown that spores from infected leaves can induce secondary cycles. Infection of green fruit was also confirmed by these experiments. The importance of preventing leaf blights and insect injuries was also emphasized.

The specificity of *C. phomoides* is challenged by the discovery that this organism was as infective on the foliage of Cucurbitaceae as the anthracnose organism isolated from squash. Foliage infection was obtained on 5 species of Cucurbitaceae and the symptoms varied from tiny spots to irregular necrotic areas to necrosis of the leaves. Isolates of *Colletotrichum* and *Glomerella* showed only trace or no infections when inoculated on 8 bean varieties used as differential hosts for the strains of *C. lindemuthianum*.

The onion anthracnose organism, *Colletotrichum circinans*, and the pea organism, *C. pisi*, induced infections on uninjured red tomato fruits, although the lesions were somewhat different from typical anthracnose lesions.

71 pages. \$1.00. MicA54-2824

CYTOTAXONOMIC STUDIES IN THE AMARYLLIDACEAE

(Publication No. 9663)

Thelma Ficker Schmidhauser, Ph. D.
University of Virginia, 1954

The present study gives an indication of the wide differences found between certain genera in the Amaryllidaceae, especially with respect to speciation.

In the genus *Crinum*, tribe Brunsvigiae, specia-

tion seems to be on the genic level since chromosome numbers and gross chromosome morphology are so stable from species to species and since interspecific hybrids occur not infrequently. Hybrids between species of *Crinum* and *Brunsvigia rosea* (Lamarck) Hann. are also possible and attention is called to the doubtful taxonomic position of the latter form.

In the genus *Amaryllis*, tribe Amaryllae, speciation appears to follow a pattern similar to that encountered in *Crinum* although here various levels of polyploidy are encountered. The genic changes also seem to have been less profound. While the known interspecific hybrids of *Crinum* are usually sterile those of *Amaryllis* are often fertile with species and hybrids being capable of intercrossing.

Some of the narrow-leaved species formerly included in *Amaryllis* are removed from that genus on both cytological and morphological grounds and placed in the genus *Rhodophiala*. The remaining narrow-leaved species had been transferred to the tribe Eustephieae under the new generic title *Phycella*. This leaves the genus *Amaryllis* a more natural group composed entirely of broad-leaved forms which have chromosome numbers based on an x of 11.

Another member of the Amaryllae, *Worsleya Rayneri*, has a somatic chromosome number of 42 indicating that this monospecific genus is specialized in some respects although it still retains morphological characters that are primitive. *Lepidopharynx deflexa*, another monospecific form, appears to be primitive in all respects.

In the tribe Eucharideae morphological, genetic and cytological study of the question of the validity of three genera - *Hymenocallis*, *Ismene* and *Elisena* - seems to be best resolved by combining them under one genus but allotting each sub-generic rank to indicate their differences. The composite genus seems to have taken its origin in South America from whence it spread northward. *Hymenocallis* proper appears to be the most dynamic group from an evolutionary standpoint; differences in chromosome types as well as differences in chromosome number seem to indicate that speciation has taken, and may still be taking place, by the formation and secondary increase of chromosomes which appear to be telocentric. Members of the *Ismene* also seem to have undergone profound changes, probably since their introduction to cultivation; polyploidy and/or hybridization are indicated. The *Elisena* are least well known since only one species, *E. longipetala*, with a somatic chromosome number of 50, was available for this study.

Two smaller genera of the Eucharideae, *Calostemma* and *Eurycles*, both seem to be relict groups and at present appear to have no direct relationship to any of the other genera of the tribe.

The following somatic chromosome numbers are reported: *Crinum asiaticum*, *C. asiaticum* type, *C. zeylanicum*, *C. pedunculatum*, *C. americanum*, *C. amoenum*, *C. Kunthianum*, *C. bulbispermum*, *C. scabrum*, *C. variabile*, *Crinum* J. C. HARVEY, and two unidentified plants of *Crinum* have 22

chromosomes; a third unidentified *Crinum* has 33. *Brunsvigia rosea* var. *rosea*, *Brunscrinum* Howardi, *Lepidopharynx deflexa*, *Amaryllis barreirasa*, *A. immaculata*, *A. maracasa*, *A. oconequensis*, *A. Reginae* var. *alberti*, and *A. striata* var. *crocata* also have 22 chromosomes; *Amaryllis aulica* has 23, *A. belladonna* L. has 22 and 33 and *A. xJohnsoni* has 22 and 44 chromosomes while *A. vittata* has 44 chromosomes. *Worsleya Rayneri* has 42 chromosomes. Two species of the new genus *Rhodophiala* Presl, *R. bifida* and *R. chilensis*, have 18 chromosomes. In the genus *Hymenocallis* taxa with 38, 40, 44, 45, 46, 48, 52 and 54 chromosomes were found while *H. Harrisiana* has 86 chromosomes. *Ismene amancaes* has 46 chromosomes while *I. narcissiflora*, *I. pedunculata* and clone ADVANCE have 104-110 chromosomes. *Elisena longipetala* has 50 chromosomes. In *Eurycles*, *E. Cunninghami* has 20 chromosomes while in the genus *Calostemma* both *C. lutea* and *C. purpureum* have 39 chromosomes.

160 pages. \$2.00. MicA54-2825

THE KETO ACIDS OF PLANTS: THEIR IDENTITY, ANALYSIS, AND METABOLIC ROLES

(Publication No. 9785)

George Hugh Neil Towers, Ph. D.
Cornell University, 1954

An investigation of the keto-acids of plants has been made.

It was found necessary to devise a new procedure for the recognition and analysis of keto-acids in view of the fact that existing methods are unsatisfactory.

The new procedure depends on the fixation of the keto-acids in the form of their hydrazones and the conversion of the isolated, purified hydrazones to amino-acids by hydrogenolysis using platinum oxide as catalyst. The amino-acids so formed are chromatographed on paper, recognized by their position and reaction with ninhydrin and, where necessary, the amino-acids are quantitatively determined by a procedure already available.

The new method was subjected to critical examination, particularly with reference to the effects of various combinations of hydrazone, catalyst, and solvent.

With the use of this procedure, the keto-acids that were expected to be present in plants have been found. These are pyruvic, oxaloacetic, and α -ketoglutaric acids. Prior to this investigation these substances had rarely been shown to be present in plants. α -Ketoglutaric acid was found to be the predominant keto-acid in most plant materials examined.

Glyoxylic acid was also found to be commonly

present and was detected in green leaves, roots, bulbs, and tubers.

A short survey was made of a number of different plants and a considerable number of acidic carbonyl compounds was discovered. These were detected as their ninhydrin reactive analogues which have been assigned reference numbers relating to their position on two-directional paper chromatograms. Maps have been prepared to locate these unidentified substances on paper chromatograms.

Of the number of unidentified keto-acids which have been found, one, designated unknown no. 1, appears to be almost universally present in plants and sometimes in rather considerable quantities, e.g., in corn leaves. Although this substance was isolated as a hydrazone the small amount did not permit for complete identification.

Of the hitherto unidentified keto-acids it was possible to identify one that occurs in the tissues of the Tulip. This substance was isolated as its 2,4-dinitrophenylhydrazone and identified as α -keto- γ -methyleneglutaric acid. In one experiment with Tulip leaves evidence was obtained for the presence of the keto analogues of glutamine and γ -methyleneglutamine.

α -Keto- γ -methyleneglutaric acid was also identified in a species of Lily. In view of the known occurrence of the corresponding amino-acid and amide in plants as far removed from the Liliaceae as the peanut plant (Leguminosae) and *Humulus* (Moraceae) it is probable that this class of compound may turn out to be of general occurrence and metabolic significance.

Although all the keto-acids of the relevant plants have not yet been identified, an attempt was made to determine the variations in keto-acid content in response to environmental change. The leaves of Mint plants and tissue explants of the phloem of carrot root provided experimental material. In the Mint plant changes were induced by alterations in the composition of the mineral nutrients supplied and by the use of long day and short day treatment during growth. Long day Mint plants were characterized by high content of α -ketoglutaric acid which is consistent with the reported accumulation of glutamic acid and glutamine in these plants under similar conditions.

Growing and non-growing cells of carrot were compared by the use of coconut milk growth factors and it was found that the general level of keto-acids in tissue explants is markedly increased in the presence of these growth factors.

The literature available on the natural occurrence of keto-acids is summarized and the new knowledge resulting from this investigation is discussed in relation to the metabolic importance of these substances.

286 pages. \$3.58. MicA54-2826

CHEMISTRY

CHEMISTRY, GENERAL

THE VOLUMETRIC DETERMINATION OF PEROXYDIPHOSPHATE

(Publication No. 9939)

Thomas Chulski, Ph.D.
Michigan State College, 1953

Tetrapotassium peroxydiphosphate was prepared by the method of Fichter and Gutzwiller¹ by electrolyzing a solution containing 302.2 g. monopotassium orthophosphate, 198 g. potassium hydroxide, 120 g. potassium fluoride, and 0.355 g. potassium chromate per liter using platinum electrodes. Their findings were substantiated except for the claim that the final product was pure white. The tetrapotassium peroxydiphosphate always contained some chromate. No method of crystallization could be found that would remove the chromate.

Tetrapotassium peroxydiphosphate was precipitated from the electrolyte of Fichter and Gutzwiller by adding solid potassium hydroxide. The product also contained chromate but the precipitation served as an efficient method for the preparation of a rather impure chromate containing tetrapotassium peroxydiphosphate which was found to be suitable as a starting material for the preparation of tetralithium peroxydiphosphate tetrahydrate.

A solution of lithium peroxydiphosphate was prepared from a solution of the crude tetrapotassium peroxydiphosphate by precipitating the potassium, phosphate, and fluoride by adding a lithium perchlorate solution. The peroxydiphosphate was precipitated from the solution as tetralithium peroxydiphosphate tetrahydrate by the addition of methanol. The material was chromate free.

A 0.1 normal solution of the tetralithium peroxydiphosphate tetrahydrate had a pH of 10.2. It decomposed to the extent of five parts per thousand in 49 days. At lower pH values the solution was less stable.

Peroxydiphosphate was determined by adding excess ferrous ions to a solution of peroxydiphosphate and back titrating the excess with potassium dichromate solution using diphenylamine sodium sulfonate as indicator. Reaction mixtures 0.25 to 1.0 molar in sulfuric acid and 0.25 to 2.0 molar in perchloric acid were found to give satisfactory results. In 1.0 to 2.0 molar hydrochloric acid solutions plausible results were obtained. The amount of excess ferrous ion was not critical. The determination could be carried out in the presence of phosphate.

The direct potentiometer titration of peroxydiphosphate with a ferrous ammonium sulfate solution was accomplished. Satisfactory results were obtained when the reaction mixture was 0.25 to 0.50 molar in sulfuric acid or 0.50 molar in phosphoric acid.

The equivalence point in the titration of peroxydiphosphate with a ferrous ammonium sulfate solution was successfully determined by means of the dead stop end point technique. Satisfactory results were obtained if the peroxydiphosphate solution was 0.25 to 1.0 molar in sulfuric acid, 0.50 to 1.0 molar in phosphoric acid, or 0.25 to 0.50 molar in perchloric acid.

An iodometric determination of peroxydiphosphate was achieved. The rate of reaction between peroxydiphosphate and iodide ions was found to be influenced profoundly by the acidity of the reaction mixture; a small increase in acidity greatly increased the rate of reaction. The determination was successful both in the absence and presence of phosphate when the reaction mixture was 1.0 molar in sulfuric acid.

113 pages. \$1.41. MicA54-2827

1. Fichter, F. and Gutzwiller, E., *Helv. Chim. Acta.*, **11**, 323 (1928).

I. THE EVALUATION OF UREA ADDUCT FRACTIONATION OF WAXES BY X-RAY AND ELECTRON DIFFRACTION AND OTHER TECHNIQUES. II. THE STRUCTURE OF METAL FILMS ON GLASS FIBRILS.

(Publication No. 9061)

Richard Lavern Dehm, Ph.D.
University of Illinois, 1954

PART I

A new method for fractionating complex mixtures of long chain compounds has been developed. This method is based on the recovery of solid molecular addition compounds which are formed by molecules of a specific size and shape with urea. The method was applied to two different commercial waxes; a fully refined macrocrystalline paraffin wax and a Be Square Amber microcrystalline wax.

Briefly the fractionation consists of adding, in small constant increments, an almost saturated solution of urea in methyl alcohol to a solution of the wax in a suitable solvent. After each addition of the urea solution, the crystalline adduct formed is removed by vacuum filtration and decomposed in water. The wax which is left floating as an immiscible layer on top of the water is then filtered off.

An x-ray diffraction technique for determining the interplanar spacings corresponding to the chain length of long chain organic molecules was modified and used to determine the long spacings exhibited by all fractions obtained. In addition, all fractions were characterized by the combined use of data obtained from melting points, molecular weights by

ebullioscopy, microcombustion analyses, optical microscopy, x-ray diffraction, and electron diffraction.

A very effective separation of the paraffin wax was accomplished using this technique. The interplanar spacings, molecular weights, and melting points were found to decrease in a regular manner from the first fraction which was removed. Thus, it is definitely established that the longer-chain material present in the mixture is preferentially removed first, probably because of the increased stability of the adduct with increased chain length, when an amount of urea which is less than the amount necessary for total adduct formation is added to a mixture of varying lengths of hydrocarbons. The presence of approximately 3 per cent of a non straight chain material in the fully refined paraffin wax was established. The microcrystalline waxes, owing to their increased complexity required several successive treatments with urea to obtain reasonably pure straight chain fractions. These microcrystalline waxes of Mid-Continent origin were found to contain as much as 50 per cent of straight chain hydrocarbons.

The general method developed here of sorting molecules by size and shape by fractional adduct formation may be applied to other complex mixtures of organic molecules.

PART II

The recently installed RCA type EMD-2 Electron Diffraction Unit has been described in some detail. In addition, methods of specimen preparation and interpretation of results have been discussed.

The structure, bonding, and texture of very fine zinc-coated glass fibrils (the 10 micron glass fibril diameter is increased to 14 microns by the application of the metal coating) have been investigated by x-ray and electron diffraction techniques. The data obtained by x-ray transmission methods indicate that a definite but irregular grain-growth takes place when the fibrils are heated during subsequent processing. This results in a rougher, more brittle, and less adherent film. By means of differential etching the metal was removed from the glass fibrils. Examination of each resulting surface by electron diffraction has indicated that the ratio of zinc oxide to zinc which is high at the surface of the film, decreases in the center, and increases again at the interface of the metal and glass. This indicates that a zinc oxide layer is essential for the bonding of the metal film to glass, analogous to the bonding of enamels to sheet metals by means of various metal oxides.

135 pages. \$1.69. MicA54-2828

I. THE PREPARATION OF SOME MERCURIAL DIURETICS. II. THE ULTRAVIOLET ABSORPTION SPECTRA OF CERTAIN AROMATIC OXIMES.

(Publication No. 9937)

Exum Dever Watts, Ph.D.
Vanderbilt University, 1954

PART I

The therapeutic agents most widely used in the control of congestive heart disease are the organic mercurials obtained by treatment of a compound of the N-allylamide type with mercuric acetate in methanol. Part I of this thesis deals with efforts to prepare new mercurials which might be more effective than the ones in current use.

Attempts to obtain addition compounds by treatment of simple N-allylbenzenesulfonamides with mercuric acetate in methanol were unsuccessful. Under similar conditions, however, N-allylsaccharin yielded an intractable oil which upon saponification yielded N-(2-methoxy-3-hydroxymercuripropyl)-o-carboxybenzenesulfonamide, m.p. 205.0-205.5°(dec.). This compound was difficultly soluble in one equivalent of alkali. Preliminary investigation suggests that this mercurial has significant diuretic activity.

The preparation and methoxymercuration of several ring-substituted N-allylphthalimides were attempted.

Efforts to prepare 4,5-dibromophthalic acid by oxidation of 4,5-dibromo-1,2-dimethylbenzene were unsuccessful.

The preparation of N-allyl-4,5-dichlorophthalimide is reported. Methoxymercuration of this compound gave N-(2-methoxy-3-acetoxymmercuripropyl)-4,5-dichlorophthalimide, m.p. 165.5-166.5°.

The preparation of N-allyl-4,5-dimethylphthalimide was achieved through the following route:
pinacol $\xrightarrow{(1)}$ 2,3-dimethyl-1,3-butadiene $\xrightarrow{(2)}$ 4,5-dimethyltetrahydrophthalic anhydride $\xrightarrow{(3)}$ 4,5-dimethylphthalic anhydride $\xrightarrow{(4)}$ N-allyl-4,5-dimethylphthalimide. Step 3 was accomplished in 49.6% yield by means of bromine in acetic acid. The methoxymercuration of N-allyl-4,5-dimethylphthalimide yielded N-(2-methoxy-3-acetoxymmercuripropyl)-4,5-dimethylphthalimide, m.p. 155.5-157.0°.

The last two mercurials described above required two equivalents of alkali to effect solution and both decomposed upon exposure to light for several weeks. Physiological tests of these compounds were unpromising.

PART II

The spectra of the following oximes were determined in iso-octane: o-methyl-, m-methyl-, p-methyl-, 2,4-dimethyl-, 3,5-dimethyl-, 3,4,5-trimethyl-, p-t-butyl-, o-chloro-, p-chloro-, p-bromo-, p-iodo-, o-methoxy-, p-methoxy-, o-nitro- (two forms), m-nitro-, p-nitro-, and unsubstituted

acetophenone oximes and p-methyl-, p-bromo-, and unsubstituted pivalophenone oximes.

The spectra of o-methyl-, m-methyl-, 2,4-dimethyl-, 3,5-dimethyl-, 3,4,5-trimethyl-, o-chloro-, p-chloro-, p-bromo-, p-iodo-, o-methoxy-, p-methoxy-, o-nitro- (high melting form), m-nitro-, p-nitro-, and unsubstituted acetophenone oximes were determined in concentrated sulfuric acid.

Marked reduction in absorption characterized the spectra of the ortho-substituted acetophenone oximes. These hypsochromic shifts were shown to parallel the unusually high rates of Beckmann rearrangement found by Cole in this laboratory. An explanation for this correlation was offered based upon the mechanism of rearrangement.

Reduced absorption was also noted in the spectra of the pivalophenone oximes.

A plot of Hammett's sigma versus λ_{\max} in sulfuric acid was made for the para- and meta-substituted acetophenone oximes, and it was observed that the values for the alkylated and p-methoxy derivatives lay near a straight line. The sigma values for the polyalkylated compounds were obtained by addition of the individual sigma values.

Introduction of a halogen into acetophenone oxime produced bathochromic shifts which increased $\text{Cl} < \text{Br} < \text{I}$.

The hypsochromic shift noted upon introduction of a m-nitro group into acetophenone oxime was attributed to a cross-conjugative effect.

The higher melting form of o-nitroacetophenone oxime was assigned the *anti* configuration upon the basis of its ultraviolet spectrum.

A bathochromic shift of 30-50 m μ was noted in the absorption spectra of all oximes upon changing from iso-octane to sulfuric acid.

142 pages. \$1.78. MicA54-2829

CHEMISTRY, BIOLOGICAL

THE NATURE OF THE THIOL GROUP OF COENZYME A

(Publication No. 10,001)

Robert E. Basford, Ph.D.
University of Washington, 1954

The oxidation of a variety of thiol compounds by 2,6-dichlorophenolindophenol has been investigated with regard to the kinetics and equilibrium position of the reaction. Various thiol compounds can be divided into three classes: (1) thiols which react rapidly and stoichiometrically on an equimolar basis with indophenol and which are oxidized to the corresponding sulfenic acids, (2) thiols which react more slowly and with a final stoichiometry of two molecules of thiol to one molecule of dye and are oxidized probably to disulfides, and (3) "potential" thiols, i.e. heterocyclic compounds which open hydrolytically to

yield sulfhydryl groups and which of necessity react very slowly with indophenol.

It was found that commercial preparations of Coenzyme A can be separated by paper chromatography into four forms all active as coenzymes. (I) was identified as a "free" thiol, (III) and (IV) as disulfides and (II) was found to contain neither "free-SH" nor S-S groups. (II) reacts with indophenol at a rate comparable to "potential" thiols and a possible cyclic structure is proposed for this form. This hypothetical structure is discussed with regard to "high energy" compounds and to the mechanism of fatty acid oxidation. 100 pages. \$1.25. MicA54-2830

A POLAROGRAPHIC INVESTIGATION OF AMINO ACIDS

(Publication No. 9543)

Victor Hyman Dayan, Ph.D.
University of Florida, 1954

The polarographic half-wave potentials of glycine, α -alanine, β -alanine, β -phenylalanine, proline, and histidine hydrochloride, all of which were found to produce polarographic waves, were determined using tetraethylammonium bromide as the supporting electrolyte. The effect of concentration on diffusion was also determined for each amino acid.

The following mechanism was established for the reduction process of glycine using the geometric properties of its wave:



It is suggested that a similar mechanism holds for the other compounds studied.

A relation was found between the acid strengths of the reducible groups and the half-wave potentials of the compounds. This relation was in agreement with the proposed mechanism which involves a proton release by the reducible group. The following empirical equation, which related acid strength of the reducible group and the half-wave potential of the compound was obtained:

$$E = -0.187 \text{ pK}_a - 0.718.$$

Imidazole hydrochloride was studied because of its similarity in structure to histidine hydrochloride. Values of the half-wave potential and the diffusion current of this compound were determined.

52 pages. \$1.00. MicA54-2831

UREA AS A SOURCE OF NITROGEN FOR THE BIOSYNTHESIS OF AMINO ACIDS

(Publication No. 9062)

Eugene Earl Dekker, Ph.D.
University of Illinois, 1954

INTRODUCTION

Those amino acids which are normal components of proteins are readily classified as "essential" or "non-essential" depending upon whether or not they can be synthesized by the animal organism out of materials ordinarily available in the diet at a rate commensurate with the demands for normal growth (1). In considering the metabolic origin of the non-essentials, one must account for: (a) the sources of the carbon chains, and (b) the sources of the nitrogen present in the amino groups.

Urea has long been recognized as the principal end-product of nitrogen catabolism in most mammals. However, a divergence of opinion exists regarding the possibility that the nitrogen of this compound may be utilized by the rat for the anabolism of the non-essential amino acids (2, 3). The present investigation was designed to obtain further evidence regarding this point. For this purpose, urea containing nitrogen-15 was synthesized and incorporated into diets of differing nitrogen content. These diets were administered to two groups of growing rats. The excreta, carcass protein, and various isolated body amino acids of both groups were analyzed for the isotope.

EXPERIMENTAL

Ammonium nitrate containing nitrogen-15 in the ammonium portion of the molecule was converted to labeled urea by a modification of the classical Wöhler reaction (4).

Two groups of three weanling rats each served as the experimental animals. One group (Group A) received a ration in which virtually all of the nitrogen was in the form of the ten essential amino acids, each at the lowest level compatible with maximum growth when accompanied by abundant supplies of the non-essentials. To the other group (Group C) was administered a diet containing 18 per cent of casein, supplemented with 0.2 per cent of methionine, as the sole source of nitrogen. The labeled urea was added as a nitrogen supplement to both of these rations. After preliminary periods of feeding the basal diets, the urea-supplemented rations were administered for 7 and 1/3 days. During this time, each group ingested 158.8 mg. of excess nitrogen-15.

Urea was obtained from the urine as the dioxanthryl derivative. Samples of carcass protein from each group of animals were subjected to acid hydrolysis and the resulting mixtures of amino acids were partially fractionated by chromatographic techniques. From these fractions, tyrosine, cystine, glutamic acid, aspartic acid, proline, and histidine were separated by selective precipitation methods. The nitrogen of these amino acids was then converted into

the gaseous state and analyzed for the isotope by means of a mass spectrometer.

SUMMARY

The results demonstrate that the rats of Group A incorporated 21.7 per cent of the administered isotope into the carcass protein. Percentages of 14.3 and 40.4 were found in the feces and urine, respectively. On the other hand, only 3.1 per cent of the administered nitrogen-15 was found in the carcass protein of the animals of Group C and 2.5 per cent in the feces. The urine of this group contained 80.6 per cent of the dose.

The levels of isotope found in the tissue amino acids of the rats of Group A were approximately 15 times higher than those of Group C. In the former group, glutamic and aspartic acids exhibited the greatest uptake of nitrogen-15, reaffirming the central role attributed to these compounds in nitrogen metabolism. Tyrosine displayed a surprisingly high extent of incorporation of the isotope. This finding may suggest that in the formation of tyrosine from phenylalanine, the latter undergoes deamination prior to oxidation. In contrast, the isotopic content of histidine, one of the essential amino acids, was quite low.

The data are believed to provide convincing evidence for the fact that, under the conditions described, the nitrogen of urea can be utilized by the rat for the anabolism of the non-essential amino acids.

78 pages. \$1.00. MicA54-2832

BIBLIOGRAPHY

1. Rose, W. C., *Physiol. Rev.*, **18**, 109 (1938).
2. Bloch, K., *J. Biol. Chem.*, **165**, 469 (1946).
3. Rose, W. C., Smith, L. C., Womack, M., and Shane, M., *J. Biol. Chem.*, **181**, 307 (1949).
4. Walker, J., and Hambly, F. J., *J. Chem. Soc.*, **67**, 746 (1895).

STUDIES ON XANTHINE OXIDASE

(Publication No. 10,069)

Richard Joseph Doisy, Ph.D.
Syracuse University, 1954

Advisor: W. W. Westerfeld

The thesis consists of two parts, both of which are concerned with the enzyme xanthine oxidase. Part one is concerned with the effect of diet on riboflavin and xanthine oxidase levels in rat liver and intestine. Part two is concerned with the effect of various inhibitors on xanthine oxidase.

Weanling rats fed diets deficient in protein or riboflavin for 2 to 4 weeks had liver riboflavin levels that were reduced approximately 40 per cent and 55 per cent respectively; the corresponding reduction in intestinal riboflavin was approximately 15 per cent

and 55 per cent. About 60 per cent of the riboflavin in normal liver was in the sedimentable particles, and the above loss of riboflavin was proportionately the same from both the particulate and supernatant fractions.

The incorporation of soy flour in the diet as a source of molybdenum had no effect on the total riboflavin content of the liver or intestine, but did increase the liver and intestinal xanthine oxidases 30 per cent and 170 per cent respectively. The amount of riboflavin bound in xanthine oxidase represents only a very small fraction of the total riboflavin present. Liver xanthine oxidase was decreased only 25 per cent by a riboflavin deficient diet.

In Part two the effect of chelating agents such as versene, 8-hydroxyquinoline, o-phenanthroline, and other inhibitors was investigated. Two different assay methods were employed: dye reduction and cytochrome c reduction.

In contrast to Mahler's studies on DPN cytochrome c reductase, the various chelating agents under study here have no inhibitory action on milk xanthine oxidase. On the contrary, they have a marked ability to activate this enzyme. This activation is presumably due to removal of inhibitory trace metals present in the system.

The effect of 8-hydroxyquinoline on chicken liver xanthine dehydrogenase is more complex. In the presence of substrate aerobic incubation with 8-hydroxyquinoline will completely inactivate the enzyme. The activity may be restored by the addition of ferrous ions, but not ferric. On the other hand, anaerobic incubation with 8-hydroxyquinoline in the presence of substrate causes no loss of activity of the chicken liver enzyme.

The inhibition of chicken liver enzyme by cupric ions was investigated. High concentrations of copper will completely block both the cytochrome c and methylene blue reductions. At levels of 7×10^{-6} M Cu^{++} the methylene blue reduction is completely blocked while 50 per cent of the cytochrome c reduction is still intact. The indication is that copper is more a specific inhibitor for methylene blue reduction than for the cytochrome c reduction.

The p-chloromercuribenzoate appears to be a more specific inhibitor for the cytochrome c reduction than the methylene blue reduction. The studies on these two inhibitors and the 8-hydroxyquinoline indicate that the two activities, that is methylene blue and cytochrome c reduction, have divergent pathways and that the activities may be differentiated.

Cyanide inhibition of chicken liver enzyme may be prevented by addition of substrate prior to the addition of cyanide. The mode of action of cyanide inhibition is still an enigma.

The inhibition of the DPNH oxidation by pteridylaldehyde, chalcone, cyanide, and antabuse is not marked with any of the enzymes as contrasted with the inhibition of hypoxanthine oxidation. Antabuse and chalcone inhibit the oxidase activity of crude rat liver enzyme when hypoxanthine is the substrate, but have no effect on the purified enzyme.

68 pages. \$1.00. MicA54-2833

A COMPARATIVE STUDY OF THE CHEMISTRY OF THE NUCLEI OF OVA, SPERMATOZOA AND LIVER CELLS IN THE FROG (RANA PIPPIENS)

(Publication No. 7585)

Marta Cancio England, Ph.D.
University of Missouri, 1954

The biochemistry and physiology of mammalian spermatozoa have been under investigation for a number of years in this laboratory. Since it is impossible to obtain sufficient amounts of mammalian ova to make a comparative study of the male and female germ cells in a single species, a comparative study of the chemistry of the spermatozoa, liver nuclei and ova nuclei in the frog was made.

The nuclear preparations used were isolated using 70 per cent sucrose as the homogenizing medium.

A quantitative relationship was found to exist between the amount of desoxyribose nucleic acid in the three types of nuclei studied and the number of sets of chromosomes in those nuclei. This seems to support the theory of the constancy of desoxyribose nucleic acid in the nuclei of a species.

It was also found that the arginine/desoxyribose nucleic acid ratio per set of chromosome is about four times higher in spermatozoa than in liver or ova nuclei. This seems to be an indication of the existence of an arginine-rich protein not related to desoxyribose nucleic acid in spermatozoa. The nature of this protein is possibly a protamine.

103 pages. \$1.29. MicA54-2834

MATERNAL NUTRITION AND CONGENITAL ANOMALIES IN THE RAT

(Publication No. 9178)

Robert Ball Grainger, Ph.D.
University of Missouri, 1954

The modification of the Steenback-Black rachitogenic diet used by Warkany for the production of congenital malformation in the rat has been found to be deficient in vitamin B_{12} and possibly folacin as well as in riboflavin. The addition of all the known vitamins required by the rat Steenback-Black diet or a casein diet did not completely prevent malformations, indicating that the diets were deficient in other respects. The deficiency may be in the quality of protein or in an unrecognized factor (s). Omission of vitamin B_{12} resulted in hydrocephalus, ocular defects and a high incidence of skeletal abnormalities. Omission of riboflavin had no effect on hydrocephalus or eye defects but increased skeletal defects. A high Ca : P ratio also increased skeletal anomalies. Soybean protein proved to be superior to casein and to a combination of corn and wheat gluten. A supplement of 0.1 micrograms or more of vitamin B_{12} proved adequate for protection against anomalies.

The alkaline phosphatase activity in tibiae of the riboflavin and vitamin B₁₂ deficient newborn was lower than normal and the rate of phosphorus deposition as measured by specific activities after P³² administrations was decreased. The specific activity of the tibia of offspring from non-deficient dams injected with P³² was 88.8% higher than the specific activity of the tibia of offspring from vitamin B₁₂ deficient dams. Evidence is presented which indicates that the bone abnormalities of offspring from malnourished dams are caused by a decreased rate of ossification and lowered alkaline phosphatase activity or by the failure of a portion of the biochemical mechanism that produces alkaline phosphatase activity. 141 pages. \$1.76. MicA54-2835

STUDIES ON THE ASSESSMENT
OF ASCORBIC ACID NUTRITURE IN THE HUMAN
AND IN THE GUINEA PIG

(Publication No. 9763)

Ruth Nellie Lutz, Ph.D.
Cornell University, 1954

The level of a nutrient in the blood should serve as an indicator of nutriture if this level can be related to the existence of a biochemical or physical lesion. The present study is concerned with ascorbic acid nutriture in the human, as determined by serum and white cell ascorbic acid content, when an excess of folic acid, a biochemical stress, is given. Studies were also made of the ability of ascorbic acid deficient guinea pigs to metabolize certain tyrosine-like compounds.

The precision of the Bessey-Lowry micro-method for the determination of white cell ascorbic acid content as carried out in this laboratory and the extent of daily variation in white cell ascorbic acid content in 3 adults fed constant high intakes of the vitamin were studied. The precision of the method ranged from ± 1.5 to ± 2.5 mg%, and was greatest when sunlight was available. The daily variation in white cell ascorbic acid content appeared to exceed but slightly the precision of the method.

Four adult subjects were saturated with respect to ascorbic acid and then given a daily intake of 40 mg of the vitamin for a 66 or 73 day period. Six subjects were partially depleted of the vitamin by ingesting the basal diet only, containing 12 ± 2 mg of ascorbic acid, for 39 days. For the next 31 or 39 days, their daily intake of the vitamin was also 40 mg. During certain periods folic acid was ingested by the subjects. Citrovorum factor excretion and the ascorbic acid content of the sera and white cells were determined. The initial white cell ascorbic acid content was not maintained at the saturation level in the 4 subjects, but it was maintained at the presupplement level in 4 of the 6 subjects who had been partially depleted of the vitamin. Other data are given to support the hypothesis that the initial nutriture of an individual may influence the amount of ascorbic

acid necessary to maintain or increase the ascorbic acid content of the white cells. There appeared to be no correlation between citrovorum factor excretion and the content of ascorbic acid in the white cells or sera, with creatinine excretion, or with urine volume. Thus, citrovorum excretion, at least under the conditions of this study, is not a useful tool in determining ascorbic acid nutriture of individuals.

It has been demonstrated that ascorbic acid deficient guinea pigs exhibit tyrosyluria following the ingestion of large amounts of the pure amino acid, but it has not been shown that tyrosine given in any other form will elicit such a response. In the present study, the urinary excretion of tyrosyl compounds and reducing substances by normal and ascorbic acid deficient guinea pigs after the ingestion of an aqueous suspension of 400 mg of tyrosine or an equivalent amount of a tyrosine-containing compound was determined. The administration of tyrosine, the ethyl ester, glycyltyrosine, and leucyltyrosine caused a significant increase in the excretion of tyrosine metabolites in the deficient animals over that noted in the normal animals. Three-amino tyrosine caused a slight increase in the excretion of these compounds, while bromopropionyltyrosine and egg albumin elicited no response. Increasing the amount of egg albumin administered until the animals received 1200 mg of protein-bound tyrosine elicited no abnormal response. 94 pages. \$1.18. MicA54-2836

CHEMICAL AND BIOLOGICAL INVESTIGATION
OF UNIDENTIFIED GROWTH FACTORS
IN CONDENSED FISH SOLUBLES

(Publication No. 9882)

John William Needham, Ph.D.
Purdue University, 1954

Major Professor: Sigfred M. Hauge

Condensed fish solubles (CFS), a by-product of the fish-processing industry, contains an unidentified growth factor(s) as well as other essential nutrients including vitamin B₁₂.

In efforts to develop a specific rat-growth assay, a variety of semi-purified basal rations were tested for their suitability for measuring the growth responses to CFS and other materials containing unidentified growth factors. Protein sources were soybean oil meal, isolated soybean protein from three different processors, and casein. These were usually extracted by various solvents or solvent mixtures in an attempt to remove any unidentified factors. Other ingredients of the basal rations were: hydrogenated cottonseed oil, cerelose (glucose monohydrate) or sucrose, reagent-grade salts, a highly-purified fish liver concentrate of vitamins A and D, and other pure vitamins. Aureomycin, sulfaguandine, purified cellulose, and iodinated casein were added to certain basal rations.

It was not possible to demonstrate a growth

response by CFS supplementation over that obtained by addition of vitamin B₁₂. Since other investigators have recently demonstrated growth responses of rats to an unidentified factor(s) in CFS over that produced by vitamin B₁₂, it is evident that the CFS-factor was already present in the basal rations used in this study, being supplied by soybean oil meal, soybean protein preparations, and casein. Evidently, the extraction methods employed did not remove the factor from these protein sources.

In microbiological studies, when increments of extracts of CFS were added to tubes containing a basal medium composed of amino acids and all known essential nutrients, graded growth responses were obtained with several *Lactobacilli*. A similar response to vitamin B₁₂ was not obtained, indicating the presence of unidentified factors in CFS for these organisms. Since a specific rat-assay was not available, it was not possible to determine whether or not the microbial growth factor(s) was the same substance which stimulated growth of animals. Therefore, elucidation of the chemical nature of the microbial growth factor(s) was postponed.

Since the CFS-factor(s) was present in the basal rations, activities of fractions of CFS (as determined by rat growth) reflected the vitamin B₁₂-contents of these preparations. This conclusion was further supported by the observation that fractions which were low in B₁₂-activity, as determined microbiologically with *Lactobacillus leihmanni* and *Escherichia coli* x-ray mutant 113-3, failed to stimulate rat growth significantly.

CFS which had been autoclaved at pH 11 for 1 hr., a procedure which inactivates vitamin B₁₂, stimulated growth of rats almost as well as the original CFS. However, bioautographic analysis of the NaCH-treated CFS indicated that all of the microbial B₁₂-activity had not been destroyed. Since the organism used is known to respond to substances other than vitamin B₁₂, it is possible that something besides B₁₂ was measured. This would indicate that an unidentified, alkali-resistant factor is present in CFS. It is not vitamin B₁₂, but a capacity for giving growth responses similar to B₁₂, and can substitute for B₁₂ in metabolic processes. When the alkali treatment was rigorous enough to destroy all microbial-growth activity, the material did not stimulate growth of rats. This would indicate that, even though the factor is more resistant to alkali than vitamin B₁₂, it can be destroyed by such a procedure.

114 pages. \$1.43. MicA54-2837

METABOLIC STUDIES ON *E. COLI* 113-3

(Publication No. 9769)

Leo Joseph Ottey, Ph.D.
Cornell University, 1954

Studies were undertaken to investigate the oxidation of acetate in *E. coli* 113-3, a mutant which requires methionine or vitamin B₁₂ for growth. Glucose

grown cells of this organism were found to possess the tricarboxylic acid cycle. This conclusion is based on inhibition studies with fluoracetate and the examination of cell free preparations. The rate of acetate oxidation in aged, glucose grown cells was stimulated by the addition of vitamin B₁₂. This stimulation was found with pyruvate but to a lesser degree. In contrast to acetate and pyruvate, no stimulation was observed on glucose oxidation.

It was postulated that vitamin B₁₂ was involved in an alternate pathway for the oxidation of acetate. This conclusion is based on the decreased of fluoroacetate inhibition in the presence of vitamin B₁₂. This decrease in fluoroacetate inhibition was not due to an increased production of oxalacetate, since the addition of malate was not as effective as vitamin B₁₂. Results obtained with malonate in combination with fluoroacetate were consistent with the postulated mechanism.

When cells of *E. coli* 113-3 were adapted to grow on acetate, the stimulating effect of vitamin B₁₂ on acetate and pyruvate oxidation was not found. However, in the presence of fluoroacetate an effect of vitamin B₁₂ was observed in acetate, pyruvate and glucose oxidation.

Vitamin B₁₂ was found to be without effect in the following enzyme systems in cell free preparations: pyruvic oxidase, acetyl-kinase, condensing enzyme, isocitric dehydrogenase, α -ketoglutaric oxidase, malic dehydrogenase, and glutathione reductase.

55 pages. \$1.00. MicA54-2838

HISTOCHEMICAL AND MICROCHEMICAL OBSERVATIONS ON THE LIPIDS OF THE INTERSCAPULAR BROWN FAT OF THE FEMALE VESPERTILIONID BAT, *MYOTIS LUCIFUGUS LUCIFUGUS*

(Publication No. 9921)

Guy-Laurent Rémillard, Ph.D.
Cornell University, 1954

The lipid content of the interscapular brown adipose tissue of *Myotis lucifugus lucifugus* was studied throughout an annual cycle by means of both histochemical and microchemical procedures. In addition, the lipid content was correlated with changes in the fresh and dry weights of the brown adipose tissue, for which purpose the water content and the total solids were likewise determined.

During the summer months, the total weight and the water content of the brown fat tissue fluctuate. Microchemical determinations show that the concentrations of total lipids, total cholesterol and total fatty acids are relatively high at this time. Histochemical analysis reveals that the cytoplasm of each brown fat cell is filled with droplets of a purely lipid composition. These droplets seem to be especially rich in neutral lipids, principally esters of glycerol and esters of cholesterol, and possibly lecithins and galactolipids. Traces of acidic lipids may also be present in these droplets.

As the animal approaches the hibernating period there is a gradual increase in the total weight of the interscapular lobes and in the size of the individual brown fat cells. This is accompanied by an increase in the lipid content of the interscapular tissue.

During hibernation, on the other hand, there is a gradual decrease in the total weight of the interscapular lobes, and in the amount of water, total lipids, total cholesterol and total fatty acids. The size of the individual brown fat cells likewise decreases during this time. Histochemical analysis, on the other hand, indicates that there is a relative increase in acidic lipids within the cytoplasmic droplets of the brown fat cells during hibernation. This may be due to the removal of neutral lipids from the fat cells. These observations suggest that during hibernation there is a gradual depletion of water and neutral lipids in the interscapular lobes of brown adipose tissue.

Near the end of hibernation, the total weight and the water content of the interscapular lobes attain their lowest levels. However, there is a relative increase in the lipid concentration of the brown adipose tissue at this time of the year. This may possibly be related to the approaching increased metabolic activity when the animals emerge from hibernation.

The anatomical distribution and the microscopic organization of the interscapular brown fat lobes of *Myotis lucifugus lucifugus* vary during a year period. During the summer months, two regions, a "cortex" and a "medulla," can be distinguished in the interscapular lobe. In tissues collected in December, the whole extent of the lobe presents a uniform picture while a narrow "cortex" and a wide "medulla" can again be recognized in tissues collected near the end of hibernation.

At all times of the year, the cytoplasm of each brown fat cell contains numerous sudanophilic lipid droplets. The remainder of the cytoplasm of the multilocular adipose cell seems to be filled with granules which apparently do not vary in composition, number and size throughout the year. Comparisons between sections treated for the demonstration of mitochondria and sections stained by Baker's acid haematein test strongly suggest that the cytoplasmic granules of the brown fat cell are mitochondria which are especially rich in phospholipids.

Variations in the color of multilocular adipose tissue throughout the year are thought to be partly due to the changes in the vascularity of the tissue and to the relative amounts of white adipose tissue associated with the interscapular lobes. As suggested by Fawcett (1952 J. Morphology, 90:363-388), it is possible that some of the brown color of multilocular adipose tissue may be due to oxidation products of phospholipids. 132 pages. \$1.65. MicA54-2839

SOME ASPECTS OF LECITHIN METABOLISM IN THE LIVER

(Publication No. 10,011)

Martin Rodbell, Ph.D.
University of Washington, 1954

In the present studies lecithin and lysolecithin caused a stimulation of oxygen uptake in a rat liver enzyme system. Of considerable interest was the observation that phosphorylcholine, glycerylphosphorylcholine, α -glycerophosphate plus choline, and lysolecithin caused a larger stimulation of oxygen uptake in guinea pig mitochondria than that expected for the oxidation of these compounds. Phosphorylcholine seemed to be the most effective compound in the stimulation of oxygen uptake and, although it apparently had no effect on the oxidation of palmitic acid or tripalmitin, a proposal is presented to the effect that phosphorylcholine was reacting with endogenous fat-like material to form a lecithin containing fatty acids which were placed on the molecule in a specific configurational manner, i.e., having an unsaturated fatty acid on the α -position and a saturated fatty acid on the β -position. This type of lecithin was represented as a "metabolically active" compound which would be amenable for the oxidation of the fatty acids. In further studies it was found that phosphorylcholine was incorporated into lecithin as an intact unit. Various diglycerides and phosphatidic acid enhanced the incorporation of the phosphorylcholine into lecithin. Investigations also demonstrated that P-32 phosphate was incorporated to a small extent into the lipid fraction, whereas choline stimulated the incorporation to an extent commensurate with the proposal that phosphorylcholine is synthesized by the mitochondria. A mechanism for the synthesis of lecithin in the guinea pig liver is proposed which emphasizes the role of lecithin in fat metabolism.

111 pages. \$1.39. MicA54-2840

STUDIES IN HUMAN AND EXPERIMENTAL PORPHYRIA

(Publication No. 9628)

Rudi Schmid, Ph.D.
University of Minnesota, 1954

1. In reviewing the literature on porphyria, particular attention has been given to questions related to pathogenesis and classification of the different clinical types of the disease, to reports dealing with porphyrin content of tissues and organs, to necropsy findings, and to disturbances of porphyrin metabolism secondary to intoxications. The porphyrin content of liver, bone marrow and erythrocytes has been studied, either by micro-assay or fluorescence microscopy or both, in a series of 31 cases

of porphyria, including 2 of the erythropoietic (congenital, photosensitive) form and 29 of the hepatic group, of which 13 were intermittent acute, 13 were "cutanea tarda," and 3 were "mixed."

2. The congenital photosensitive form is best designated as erythropoietic, on the basis of abnormal porphyrin formation in relation to the degree and type of normoblastic activity in the bone marrow. Two morphologically different types of normoblasts are found in the bone marrow. Only cells of the "abnormal" line exhibit excessive porphyrin formation, which appears to take place largely, if not entirely, in the normoblastic nucleus. The spleens in these cases also contained large amounts of uroporphyrin, probably representing destruction of porphyrin-laden erythrocytes. This is believed to be related to diminished erythropoiesis in response to a reduced rate of blood destruction.

3. In the hepatic group the bone marrow porphyrin content was consistently normal, but the amounts of porphyrin or porphyrin precursor in the liver were invariably increased, usually to a marked extent. In the intermittent acute cases, the urine and liver contained colorless porphyrin precursors, especially the Ehrlich-reacting porphobilinogen, but relatively little preformed uroporphyrin. These cases were characterized by abdominal and/or nervous manifestations without photosensitivity. In the photosensitive "cutanea tarda" cases the liver contained chiefly preformed porphyrin with relatively little precursor. In a case of "mixed" type, studied over a long period, chemical and clinical manifestations of the intermittent acute and of the "cutanea tarda" variety have been noted separately, at different times. The cases in the hepatic group often exhibited liver functional impairment or structural changes, including cirrhosis.

4. In rabbits, the porphyrin content of bone marrow, circulating red cells and liver have been studied under a variety of stimuli to erythropoiesis, including phenylhydrazine, hemorrhage, low oxygen tension and lead intoxication. In all instances, copro- and protoporphyrin concentrations of bone marrow and red blood cells were markedly increased, whereas, the liver porphyrins remained normal. In lead poisoning, uroporphyrin I was crystallized from the bone marrow. Treatment of rabbits with a combination of lead, phenylhydrazine and exposure to light resulted in marked temporary uroporphyrinuria and porphobilinogenuria.

5. Administration of allyl-isopropyl-acetyl-carbamid (Sedormid) to rabbits and rats produced an hepatic form of porphyria. The liver of these animals contained large amounts of proto-, copro- and uroporphyrin and porphobilinogen. The protoporphyrin was excreted only, and the coproporphyrin chiefly, in the bile, most of the uro-type porphyrins appearing in the urine, in amounts ranging up to 60 milligrams in 24 hours in rabbits. The porphyrin content of erythrocytes, bone marrow, spleen and brain were within normal limits. In Sedormid poisoned rats and rabbits the hepatic catalase activity decreased to very low values, simultaneously with the increase in porphyrin formation in the liver. On

the other hand, catalase activity in circulating red blood cells, cytochrome C concentration in the liver and hepatic cytochrome oxidase activity remained within normal limits, even after prolonged Sedormid administration. By following the rate of incorporation of isotopically labelled glycine into the prosthetic group of catalase, it was shown, that Sedormid interfered with the formation of the enzyme in the liver. The excessive hepatic porphyrin formation may be secondary to this block in catalase synthesis.
169 pages. \$2.11. MicA54-2841

SOME OF THE GENERAL CHEMICAL PROPERTIES OF THE PROTEINS IN HOG HAIR

(Publication No. 9898)

George Leopold Tritsch, Ph.D.
Purdue University, 1954

Major Professor: R. C. Carley & H. C. Reitz

The reaction between hog hair keratin and sodium sulfide was studied. This protein is very rich in cystine, and its insolubility in the usual protein solvents is attributed to its cystine interpeptide bridges. The sodium sulfide reduces this interpeptide bond, and thus disperses the protein.

When such a dispersion is acidified, the protein is reprecipitated in amorphous form. It was possible to isolate two fractions: One was insoluble in acid and salt solutions, while the other precipitated only when the salt and acid were dialyzed away. From the behavior of these two fractions and the yields obtained, it was considered reasonable to identify the acid and salt insoluble protein with the cortex of the hair, and the other fraction with the medullary hair protein.

Staining the sodium sulfide treated hair with nitroprusside revealed that the reducible disulfide bonds are confined almost exclusively to the cortex of the hair.

The rate of dissolution of hog hair by sodium sulfide was determined. The change in viscosity of the dispersion with time of contact between sodium sulfide and hog hair was observed. The viscosity changed very rapidly at first, and then levelled off to a value that remained constant. The rapid initial reaction is associated with an attack on the disulfide bonds in the peripheral part of the hair (cortex). The slower reaction that follows is thought to involve a slow alkaline hydrolysis of the disulfide-poor medullary protein. Chromatography of the keratin dispersions revealed that peptides, and no amino acids are liberated during the reaction between sodium sulfide and hog hair.

Several 2,4-dinitrophenyl derivatives of the dispersed and reprecipitated keratin were prepared, the proteins hydrolyzed, and the chromatographic behavior of the hydrolyzates compared to that of the 2,4-dinitrophenyl derivatives of cystine, cysteine, cysteic acid, and lanthionine. Only N-2,4-dinitrophenyl

cysteic acid could be detected in the keratin hydrolyzates. It was also shown that sodium sulfide can attack cystine to give cysteine and cysteic acid. Sodium sulfide reacts with lanthionine to give cystine and cysteic acid. One may therefore conclude that cystine, as the free amino acid, or as a part of a peptide chain is in equilibrium with cysteine in sodium sulfide solution. The cysteine is readily oxidized to cysteic acid. No evidence was obtained for the formation of lanthionine in sodium sulfide solutions.

142 pages. \$1.78. MicA54-2842

**A BIOCHEMICAL STUDY OF CELLULOSE
SYNTHESIS BY *Acetobacter xylinum***

(Publication No. 9722)

Howard H. Woeber, Ph.D.
University of Florida, 1954

The effects of variations of the pH and of the concentrations of media components on cellulose formation by *A. xylinum* were determined in media containing glucose. The initial pH of the medium was found to have a profound effect on cellulose production. Also, a post-inoculation adjustment of the pH of a culture to pH 7 resulted in a marked increase in the yield of cellulose. The influence of the concentrations of glucose, yeast extract and phosphate could, in a large measure, be attributed to effects on the pH of the culture. The increase in yield produced by the addition of ethanol to the media was apparently not due to the pH effect.

The highest yield of cellulose, 43.6 per cent, was obtained in a medium containing 0.2 per cent glucose, 2.5 per cent yeast extract and 1 per cent ethanol. This medium was adjusted to pH 6.7 with 0.044 M phosphate.

Total cellulose production in cultures containing glucose was reached within 48 hours. The rate of cellulose formation in media containing mannitol was slower, total yield being obtained after 72 to 96 hours of incubation.

Inocula adapted to fructose produced the highest yields of cellulose from mannitol and fructose. This was believed to indicate that the oxidation of mannitol to fructose was necessary before cellulose could be formed in this medium. The results of the experiment are believed to point out the value of employing the techniques of simultaneous adaptation in future research.

Under the conditions of the experiments, cyanide and bisulfite ions were inhibitory to cellulose production in media containing mannitol, while fluoride ion was without effect. Malonic acid had little influence on cellulose production when present in the media before inoculation. A slight increase in cellulose yields obtained with malonic acid in a glucose medium was attributed to the pH effect.

Pantothenic and *p*-aminobenzoic acids were found to be definitely stimulatory to cellulose production in a chemically defined medium.

A cellulose yield of 26 per cent obtained in a chemically defined medium indicated that experiments with radioactive labeled substrates would be feasible in such a medium.

92 pages. \$1.15. MicA54-2843

CHEMISTRY, INORGANIC

**REACTIONS OF SYMMETRICAL GERMANIUM (IV)
COMPOUNDS WITH NITROGEN DONOR MOLECULES**

(Publication No. 9791)

Robert Luman Barnard, Ph.D.
Cornell University, 1954

Reactions of silicon and tin compounds with substances whose molecules are potentially capable of entering into donor-acceptor bonding are well known. In the case of tin, the characteristic reaction is the formation of molecular addition compounds, whereas silicon compounds, except under the most optimum conditions, undergo complex metatheses when reacted with donor molecules.

Corresponding reactions of compounds of the intermediate element, germanium, have not previously been studied extensively. The few investigations which have been reported indicate that germanium parallels silicon in its reactions. In most of these cases, however, conditions which would most favor the formation of an addition compound were not chosen, and it was believed that by proper choice of reactants and by carefully controlling the conditions of the reactions, molecular addition compounds of germanium could be produced. Accordingly, a study was made of systems involving reactions of germanium (IV) compounds with several nitrogen donor molecules, the ultimate goal of the investigation being to increase the available knowledge concerning the tendency for germanium to form a donor-acceptor bond.

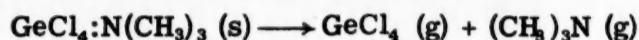
Preliminary studies were made of systems involving germanium tetramethyl with ammonia, trimethylamine, and methyl cyanide. In no case was any evidence observed of a reaction between the two components.

Germanium tetrafluoride and ammonia appeared to react in a ratio of one mole of GeF_4 to 1.8 moles of NH_3 , as indicated both by a tensimetric study of the reaction and by chemical analysis of the product of the reaction. The reaction product, under vacuum at 150°C ., partially sublimed with decomposition. The sublimate consisted of a mixture of ammonium fluo-germanate and other unidentified substances.

Preliminary work on the systems: $\text{GeF}_4-(\text{CH}_3)_3\text{N}$ and $\text{GeF}_4-\text{CH}_3\text{CN}$ indicated that these systems were not amenable to detailed study. The $\text{GeF}_4-(\text{CH}_3)_3\text{N}$ system involves complex metathetical reactions somewhat like those of the GeF_4-NH_3 system. The $\text{GeF}_4-\text{CH}_3\text{CN}$ reaction product sublimed easily and

completely at 50° C. under vacuum, but had very low vapor pressure at room temperature, was unstable in moist air, and was insoluble in, or reacted with, all of the common organic solvents.

Reaction of germanium tetrachloride with trimethylamine resulted in the formation of a colorless, crystalline compound whose chemical analysis corresponded with the formula, $\text{GeCl}_4 \cdot \text{N}(\text{CH}_3)_3$. The crystals were monoclinic prisms or tablets, showing frequent twinning. The compound was volatile at room temperature and could be sublimed readily. Infrared spectra and vapor density measurements indicated that the vapor was nearly or quite completely dissociated into an equilibrium mixture of GeCl_4 and $(\text{CH}_3)_3\text{N}$ vapors. From vapor pressure-temperature data, the heat for the reaction



was calculated to be +13.8 kcal. per mole.

In a sealed tube, the crystalline compound melted sharply at 80° C. to form a liquid phase which, however, underwent thermal decomposition rapidly, yielding GeCl_4 and other unidentified non-volatile substances containing germanium, chlorine, and nitrogen.

In benzene solution the behavior of this compound was anomalous, with apparently some, but not complete, dissociation.

As yet not enough is known about the compound $\text{GeCl}_4 \cdot \text{N}(\text{CH}_3)_3$ to determine whether a donor-acceptor bond is formed between the germanium and nitrogen atoms. However, comparison of the known properties of this substance with those which are characteristically associated with various bond types gives some indication that the formation of a donor-acceptor bond is not improbable.

57 pages. \$1.00. MicA54-2844

GAMMA LOOP STUDIES IN THE IRON-SILICON AND THE IRON-SILICON-TITANIUM SYSTEMS

(Publication No. 9932)

Gordon George Bentle, Ph.D.
Vanderbilt University, 1954

Major Professor: W. P. Fishel

The gamma iron region in the iron-silicon and iron-silicon-titanium systems was investigated. The dilatation method was used to determine the alpha-to-gamma and gamma-to-alpha transformations. The region of stable alpha, delta, and gamma iron was found in each system.

Armco iron, silicon, and titanium of high purity were used. The iron was melted in an induction furnace, and the metal was poured into baked core-sand molds. Dilatation samples four inches long and three-fourths inch in diameter were formed. Turnings for analysis were taken from the dilatation samples.

A drawing of the dilatation apparatus is included

in the thesis. The dilatation apparatus gave reproducible data to approximately 1230° C. The Ac4 transformation temperatures above 1215° C. were estimated from the data of previous investigators.

The temperature of transformation data was taken at a heating rate of 2 to 3° C. per minute. Three samples were heated at 1° C. per 20 minutes. No change in the Ac3 beginning temperature was noted.

A double gamma loop was found in the iron-silicon system based on the transitions in 15 alloys. The outside loop is the beginning of the alpha-to-gamma transformation and extends to 1.80 per cent. silicon; the inside loop is the completion of that transformation and extends to 1.50 per cent. silicon. The outside loop describes a smooth curve, beginning at 905° C., with the point of maximum composition at 1115° C.

The iron-rich corner of the iron-silicon-titanium system was studied to ascertain the effect on the Ac3 transformation temperature of alloying with iron two gamma-loop-forming elements in varying proportions. Thirty-eight alloys were used to determine the ternary gamma region. Two boundaries, represented by curved surfaces, were determined. The inner boundary represents the maximum solubility of silicon and titanium together in gamma iron, and the outer boundary the solutions of these elements in body-centered cubic iron in equilibrium with the gamma solutions.

An equilateral triangle with the compositions of the alloys was drawn after the method of Roozeboom. The iron-rich corner of the ternary system is shown. Isotherms were drawn for several different temperatures.

The isotherms were drawn using data from this thesis on the iron-silicon system and on the iron-silicon-titanium alloys. Data on the iron-titanium system was taken from the literature. From the estimated isotherms, it was concluded that silicon and titanium are more than additive in their effect on the Ac3 transformation at low concentrations. Very near the line separating the alpha and gamma regions, the two are subtractive. That is, an addition of silicon to a binary alloy of titanium and iron increases the amount of titanium necessary if it were used alone to eliminate the Ac3 transformation.

Photographs of a model representing the ternary systems are presented.

59 pages. \$1.00. MicA54-2845

STUDIES ON THE SYNTHESIS OF HYDRAZINE

(Publication No. 9055)

Ervin Colton, Ph.D.
University of Illinois, 1954

An organic derivative of hypochlorous acid, *t*-butyl hypochlorite, has been substituted for sodium hypochlorite in a detailed study of the synthesis of hydrazine. *t*-Butyl hypochlorite has been shown to react in every respect as does sodium hypochlorite

so far as oxidizing action toward ammonia and ammonia derivatives is concerned.

t-Butyl hypochlorite reacts with aqueous solutions of ammonia first to form monochloramine which then is further ammonolyzed by large quantities of ammonia to form hydrazine. The formation of chloramine was confirmed spectrophotometrically and by identification of *p*-chlorobenzalchlorimine. The yield of hydrazine from aqueous ammonia and *t*-butyl hypochlorite depends upon (a) the mole ratio of ammonia to hypochlorite; (b) the presence of a permanent base such as sodium hydroxide, and (c) the use of inhibitors such as gelatin. It is postulated that the active intermediate in hydrazine synthesis from ammonia and hypochlorite is the chloramide ion, NHCl^- .

t-Butyl hypochlorite reacts with urea and other ammonia derivatives such as biuret or ammonium carbamate, in alkaline solution, to form hydrazine. The initial reaction product between urea and *t*-butyl hypochlorite is *N*-chlorourea, identified spectrophotometrically. The yield of hydrazine from urea depends upon (a) the mole ratio of urea to hypochlorite; (b) the mole ratio of base to urea, and (c) the presence of an inhibitor such as gelatin. The active intermediate is believed to be the $\text{H}_2\text{NCONCl}^-$ ion, which is formed before a typical Hofmann rearrangement occurs to give hydrazine as the final product.

Liquid ammonia is oxidized by *t*-butyl hypochlorite first to form monochloramine which reacts with further amounts of ammonia to yield hydrazine. The yield of hydrazine from liquid ammonia depends, among other factors, upon (a) the mole ratio of ammonia to hypochlorite; (b) the degree of dilution of the hypochlorite before addition to the ammonia, and (c) the temperature. The presence of added electrolytes, both ammonium and alkali metal salts, has the effect of decreasing the yield of hydrazine from liquid ammonia and *t*-butyl hypochlorite.

76 pages. \$1.00. MicA54-2846

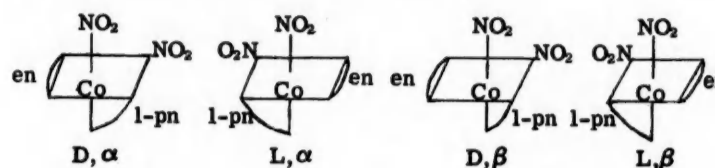
THE STEREOCHEMISTRY OF COMPLEX INORGANIC COMPOUNDS OPTICAL-GEOMETRIC ISOMERISM OF THE DINITRO-ETHYLENEDIAMINE-ISOBUTYLENEDIAMINE-COBALT (III) ION

(Publication No. 9057)

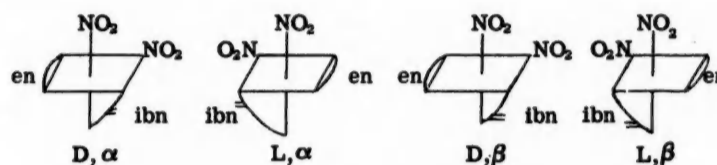
William Edward Cooley, Ph.D.
University of Illinois, 1954

In 1918 Werner and Smirnoff¹ reported the resolution of the *cis*-dinitro-ethylenediamine-propylenediamine-cobalt (III) ion into all eight of the theoretically possible isomers. Four of these isomers are shown for *levo*-propylenediamine (1-pn); four corresponding forms exist for *dextro*-propylenediamine. The methyl group on the propylenediamine molecule is indicated by a short line. The α and β forms are geometric isomers, forming different crystal types, while the D and L forms are optical isomers. The rotations of polarized light produced by the isomers illustrated above are all different. Each of these

forms has an optical antipode among the four forms containing *dextro*-propylenediamine. These characteristics of the eight isomers are described by the term optical-geometric isomerism.



This study has shown that the *cis*-dinitro-ethylenediamine-isobutylenediamine-cobalt (III) ion, which contains no optically active ligand, also exhibits optical-geometric isomerism. The four theoretically possible isomers of $\text{cis-}[\text{Co en ibn}(\text{NO}_2)_2]^+$ have been isolated.



Because of its geometric isomerism the compound $\text{cis-}[\text{Co en ibn}(\text{NO}_2)_2] \text{Br}$ crystallizes as rhombic prisms (α form) and needles (β form). These designations have not been correlated with the molecular structures as labeled above. Each of the geometric isomers has been resolved into optical antipodes.

To prepare the $\text{cis-}[\text{Co en ibn}(\text{NO}_2)_2]^+$ ion, $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$ was treated with ethylenediamine to form $[\text{Co en NH}_3(\text{NO}_2)_3]$. This was converted to $[\text{Co en ibn}(\text{NO}_2)_2]\text{NO}_2$ by reaction with isobutylenediamine. The *cis* and *trans* forms of $[\text{Co en ibn}(\text{NO}_2)_2]\text{NO}_2$ were separated by concentrating the solution and precipitating with alcohol the less soluble *cis* form. The nitrite salts were converted to the bromides with sodium bromide and then to the *d*- α -bromocamphor- π -sulfonates with silver *d*- α -bromocamphor- π -sulfonate. These salts were fractionally crystallized to separate the four isomers, which were re-converted to the bromides with hydrobromic acid.

An improved method has been developed for the preparation of $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$. This method yields the complex in large laboratory quantities in a highly pure state.

The ultraviolet absorption spectra of *cis* and *trans-}[\text{Co en ibn}(\text{NO}_2)_2]^+ have been determined. The absorption maxima of the *trans* form are nearer the visible band, respectively, than those of the *cis* form. These findings agree with those of Basalo² for analogous complexes.*

Extension of the study to include demonstration of optical-geometric isomerism for the ion $\text{cis-}[\text{Pt en ibn Cl}_2]^{++}$ was attempted unsuccessfully. The ion could not be prepared by any of the methods tried.

59 pages. \$1.00. MicA54-2847

1. Werner: *Helv. Chim. Acta*, 1, 5 (1918).
2. Basalo: *J. Am. Chem. Soc.*, 72, 4393 (1950).

THERMAL ANALYSIS OF TWO COMPONENT SYSTEMS

(Publication No. 10,053)

Michael J. Elkind, Ph.D.
Wayne University, 1951

Adviser: J. Russell Bright

STATEMENT OF THE PROBLEM

The object of this work is to elaborate upon the amphoteric (amphiprotic) properties of certain derivatives of ammonia by means of temperature-composition studies in two component systems involving either two liquids or one liquid and one gaseous component. Application of the physicochemical method of thermal analysis renders possible the establishment of the existence of possible molecular addition compounds, which in themselves offer a very important means for the elucidation of chemical bonding.

A. Recent work has shown that amides of carboxylic acids stand at a point intermediate between ammonia and carboxylic acids in the Brønsted scale of acidities.^{1,2} The system formamide-ammonia gave evidence for two molecular compounds: $\text{HCONH}_2 \cdot \text{NH}_3$ and $\text{HCONH}_2 \cdot 2\text{NH}_3$.³ It was therefore decided to conduct an investigation of three similar systems in which the strength of the base and acid were somewhat different and both components are liquids.

1. The system triethylamine-formamide.
2. The system triethylamine-dimethylformamide.
3. The system dimethylaniline-dimethylformamide.

B. The second phase of the problem concerns itself with an investigation of the possibility of compound formation between a tertiary ammonia derivative and the polyhalogenated methane derivative, carbon tetrachloride. Pyridine has been shown to form the following compounds with the polyhalogenated methanes, chloroform, bromoform, iodoform, and carbon tetrachloride:

- | | |
|--|---|
| a. $\text{C}_5\text{H}_5\text{N} \cdot \text{CHCl}_3$ | d. $3\text{C}_5\text{H}_5\text{N} \cdot \text{CHI}_3$ |
| b. $3\text{C}_5\text{H}_5\text{N} \cdot \text{CHBr}_3$ | e. $\text{C}_5\text{H}_5\text{N} \cdot 2\text{CCl}_4$ |
| c. $2\text{C}_5\text{H}_5\text{N} \cdot \text{CHBr}_3$ | |

The compound indicated in (e) cannot be accounted for in terms of hydrogen bonding as is possible for the others. It is, however, anomalous and not explainable as are the other compounds given as being due to the expansion of the valence shell of one or more halogen atoms.⁴ In a later work, however, these investigators⁵ used a somewhat stronger base than pyridine, 2,6-lutidine, in conjunction with carbon tetrachloride and found no evidence for the formation of any addition compounds between the two given components. Steric factors effective in the 2,6-lutidine molecule are given as a plausible explanation. Polarization measurements with the tetrahalomethanes, however, indicate a definite tendency to form complexes but to a less extent than with trihalogenated compounds.⁶ This together with the fact that carbon tetrachloride reacts with trimethylamine to produce an unidentified compound⁷ prompted us to investigate a system involving carbon tetrachloride and a tertiary amine in the aliphatic series and carbon tetrachloride with a tertiary amine in the aromatic

series. The following two systems in which both compounds are liquids were therefore chosen:

1. The system triethylamine-carbon tetrachloride.
2. The system dimethylaniline-carbon tetrachloride.

C. The third phase of the investigation undertaken is concerned with two component systems in which one component is a gas. Various molecular addition compounds of sulfur dioxide have been shown to exist in Chapter I. However, addition compounds involving amides and esters with sulfur dioxide have not been fully examined. Certain aliphatic esters should be stronger bases in the presence of the acid sulfur dioxide than their corresponding acids. Likewise amides of carboxylic acids and those substituted with negative groups should afford the possibility of compound formation with sulfur dioxide. This would account for the large solubility of sulfur dioxide in dimethylformamide.⁸ Accordingly we decided to examine the following systems:

1. The system dimethylformamide-sulfur dioxide.
2. The system formamide-sulfur dioxide.
3. The system ethyl acetate-sulfur dioxide.
4. The system n-propyl acetate-sulfur dioxide.

SUMMARY AND CONCLUSIONS OF EXPERIMENTAL DATA

A study by thermal analysis has been made for the following two component systems:

1. The system: triethylamine-carbon tetrachloride. A simple eutectic occurs at -120° and 90 mole per cent triethylamine. The transition point of alpha and beta carbon tetrachloride was shown to be about -45° .
2. The system: dimethylformamide-dimethylaniline. A simple eutectic was shown to occur at -64° and 86.27 mole per cent dimethylformamide.
3. The system: dimethylaniline-carbon tetrachloride. A single eutectic was established at -42.5° and 40 mole per cent dimethylaniline.
4. The system: dimethylformamide-sulfur dioxide. A white 2:1 addition compound, $2\text{HCON}(\text{CH}_3)_2 \cdot \text{SO}_2$ was shown to exist at 66.01 mole per cent dimethylformamide, having a melting point of -45.3° . The broadness of the curve indicated some dissociation in the liquid state. The two eutectics occurred at -67.6° and 87.5 mole per cent dimethylformamide and at -84° and 51.5 mole per cent dimethylformamide. Suggested electronic structures are given for the compound.
5. The system: formamide-sulfur dioxide. A 2:1 addition compound is suggested from the nature of the curve, forming at about 66 mole per cent formamide, and having an incongruent melting point of about -60° . A single eutectic occurs at -86.4° and 34.62 mole per cent formamide.
6. The system: formamide-triethylamine became immiscible after 1.50 mole per cent triethylamine. Both the esters ethyl acetate and n-propyl acetate gave excessive supercooling with sulfur dioxide and consequently no data was obtained for the systems ethyl acetate-sulfur dioxide and n-propyl acetate-sulfur dioxide. The system triethylamine-dimethylformamide was likewise unsuccessfully investigated since the two components became immiscible at low temperatures.

91 pages. \$1.14. MicA54-2848

1. S. English and W. E. S. Turner, J. Chem. Soc., 107, 774 (1915).
2. H. Sisler, A. W. Davidson, R. Stoenner, and L. Lyons, J. Am. Chem. Soc., 66, 1888 (1944).
3. H. Sisler, C. Vander Werf and S. Stephanou, J. Am. Chem. Soc., 68, 2538 (1946).
4. A. Davidson, C. Vander Werf and L. Boatright, J. Am. Chem. Soc., 69, 3045 (1947).
5. C. Vander Werf, A. Davidson, and C. Michaelis, J. Am. Chem. Soc., 70, 908 (1948).
6. S. Glasstone, Trans. Faraday Soc., 33, 200 (1937).
7. W. C. Davies, E. B. Evans, and H. R. Whitehead, J. Chem. Soc. (1939), 644.
8. J. C. Woodhouse, U.S. 2,251,216 (1941).

**COPRECIPITATION OF THALLIUM
WITH SILVER CHLORIDE PRECIPITATED
FROM HOMOGENEOUS SOLUTION**

(Publication No. 10,090)

John Ivan Peterson, Ph.D.
Syracuse University, 1954

This problem consisted of two parts: first, to develop a method of precipitating silver chloride from homogeneous solution; second to study the coprecipitation of some ion with this silver chloride.

The method of precipitating silver chloride which was devised involves the gradual release of silver ion from the silver-ammonia complex. This is accomplished by the slow hydrolysis of a water soluble ester, β -hydroxyethyl acetate, in the solution. The hydrolysis of the ester lowers the pH of the solution so that ammonia is converted to ammonium ion. The silver ion is released from the complex by this reaction of the ammonia part of the complex. The silver ion thus released combines with chloride ion in solution to form crystals of silver chloride.

The crystals formed in this manner are about 0.1 millimeter in diameter. The crystals formed at 25° C. or below are cubic in shape, while those formed at 60° C. consist of flakes with a sponge-like structure.

Thallous ion was chosen for the coprecipitation study. As the crystals of silver chloride form, thallous ion in solution becomes incorporated in the crystals. The amount of thallium in the crystals is so small that the radioisotope thallium-204 was used for the study.

A method of determining thallium-204 in the silver chloride crystals was developed. This was done by dissolving the crystals in potassium cyanide solution and then precipitating the thallium in this solution with thionalide. The radiothallium in this precipitate was determined by measuring the radioactivity of the precipitate.

The coprecipitation study showed that thallium is incorporated in the growing silver chloride crystals approximately in proportion to the concentration of thallous ion in solution. The extent of coprecipitation was independent of the silver ion concentration

in solution. This observation was explained by assuming that coprecipitation of thallium occurred by its adsorption on the silver chloride surface according to the Langmuir equation with simultaneous growth of the crystal. The thallium adsorbed is covered by further growth of the crystal resulting in inclusion of the thallium in the crystal.

This work is best classified as a case of O. Hahn's internal adsorption.

108 pages. \$1.35. MicA54-2849

**STABILIZATION OF VALENCE
THROUGH COORDINATION: I. THE STABILITIES
OF SOME COMPLEXES OF α -AMINO ACIDS
WITH DIVALENT METALS. II. A POLAROGRAPHIC
STUDY OF THE COMPLEXES OF HYDRAZINE
WITH ZINC AND CADMIUM**

(Publication No. 9125)

Robert Lee Rebertus, Ph.D.
University of Illinois, 1954

A convenient criterion of the stability of labile complexes is stability toward oxidation or reduction. The redox potential is then a quantitative measure of the degree of stability. Many labile complexes exhibit reversible behavior, and potential values may be obtained directly. Where irreversible electrode processes occur, stability constants may often be determined by other means; these, in turn, may be related to redox potentials.

I. The Stabilities of Some Complexes of α -Amino Acids With Divalent Metals

The stabilities of the complexes of glutamic acid, ornithine, norvaline, and valine have been determined by the polarographic, pH titrimetric, and spectrophotometric techniques. For each series of complexes, the values of stability constant decrease in the order: Cu, Ni, Zn, Co, and Cd. It was confirmed that the stability constant is a linear function of the second ionization potential of the metal.

The mono-(glutamato) complexes of cadmium(II), cobalt(II), zinc(II), and nickel(II) are more stable than the corresponding mono-(norvalinato), mono-(valinato), or mono-(ornithinato hydrochloride) complexes. Mono-(glutamato) nickel(II) is paramagnetic, non-conducting, and relatively insoluble. Mono-(glutamato) cadmium(II) adds one bromide ion and does not undergo ion-pair formation with tripositive, non-complexing ions. These mono-(glutamato) complexes probably have the tetrahedral configuration in which three coordination positions are occupied by the glutamate ligand.

Mono-(norvalinato) copper(II) ion is more stable than either mono-(sodium glutamato) or mono-(ornithinato hydrochloride) copper(II) ion. Consideration of visible and ultraviolet absorption spectra indicates that the chromophore is identical in each of these complexes and, therefore, that each ligand is

bidentate in a planar configuration. The result of either a (+) or (-) charge on the uncoordinated functional group of the ligand tends to lower the stability of the copper chelates.

The lesser stability of the ornithinato complexes of the divalent metals is attributed to the electrostatic interaction between the ω -ammonium group of the ligand and the central metal ion. The decrease in stability caused by the uncoordinated carboxylate group of the copper complexes probably results from a distortion of normal configuration.

The second norvalinate group, which must only replace two molecules of water, coordinates more easily than the second glutamate group, which must replace water and the ω -carboxylate group in the tetrahedral structures, or the second ornithinate group.

II. A Polarographic Study of the Complexes of Hydrazine With Zinc and Cadmium

The polarographic behavior of zinc and cadmium ions in hydrazine media at various pH values has been investigated. The reduction processes are diffusion controlled and reversible. At pH 9 or below the half-wave potential of zinc ion is dependent only upon the concentration of hydrazine. The aquated zinc ion reacts with hydrazine to form the species $[\text{Zn}(\text{N}_2\text{H}_4)(\text{H}_2\text{O})_3]^{++}$, $[\text{Zn}(\text{N}_2\text{H}_4)_2(\text{H}_2\text{O})_2]^{++}$, $[\text{Zn}(\text{N}_2\text{H}_4)_3(\text{H}_2\text{O})]^{++}$, and $[\text{Zn}(\text{N}_2\text{H}_4)_4]^{++}$. The overall formation constants are 2.5×10^3 , 5.0×10^3 , 6.0×10^3 , and 7.5×10^3 . Above pH 9 the half-wave potential is dependent both upon pH and concentration of free hydrazine. Zinc hydroxide is in equilibrium with soluble hydroxyhydrazine zinc complexes.

The half-wave potential of cadmium ion depends only upon the concentration of free hydrazine. The species $[\text{Cd}(\text{N}_2\text{H}_4)(\text{H}_2\text{O})_3]^{++}$, $[\text{Cd}(\text{N}_2\text{H}_4)_2(\text{H}_2\text{O})_2]^{++}$, $[\text{Cd}(\text{N}_2\text{H}_4)_3(\text{H}_2\text{O})]^{++}$, and $[\text{Cd}(\text{N}_2\text{H}_4)_4]^{++}$ are formed successively in solution. The overall formation constants are 1.78×10^2 , 2.50×10^2 , 6.00×10^2 , and 7.83×10^3 . At low concentrations of hydrazine, cadmium hydroxide is in equilibrium with hydrazine cadmium complexes. 90 pages. \$1.13. MicA54-2850

NITROGEN COMPOUNDS OF THE PHOSPHORIC AND PHOSPHONIC ACIDS

(Publication No. 9145)

William Channing Smith, Ph.D.
University of Illinois, 1954

INTRODUCTION

The recent discovery that certain organic derivatives of the phosphoric and polyphosphoric acids possess biological activity has stimulated considerable research in the organophosphorus field since the end of World War II. The preparation and study of phosphoric and phosphonic acid derivatives into which hydrazine was introduced as replacement for the

hydroxyl group was begun in this laboratory by Gher (1); such a modification of structure was felt to be worthy of consideration in connection with the enhancement of biological activity, in view of the toxic nature of the analogous C-N-N linkage. The preparation and characterization of amides of phenylphosphonic acid and phenylphosphonothionic acid was also undertaken because it was felt that these substances might constitute useful starting materials for the preparation of the corresponding hydrazides.

Although the synthesis of new chemical compounds of potential biological value was one objective of this study, exploratory work of this nature is also of theoretical interest since it provides information with respect to the degree of similarity of the C-N and P-N linkages in the carbonic and corresponding phosphoric, phosphonic and phosphinic acid derivatives.

HISTORICAL

The amides of the phosphoric, phosphonic and phosphinic acids may be looked upon as aquo ammono and ammono derivatives of the parent aquo compounds. An analogous and equally extensive series of thiono compounds, in which the oxygen (oxo) atom is replaced by sulfur, can also be visualized. The mono-, di- and triamides of phosphoric acid have been prepared (2,3,4), but the amides of the phosphonic and phosphinic acids are still unknown. Derivatives representative of all but one of these classes have been prepared, however, as have compounds illustrative of many of the thiono analogs.

Replacement of one or more of the $-\text{NH}_2$ groups in the ammono compounds cited above by the hydrazide radical leads to another group of compounds for which an equally large number of organic derivatives can be postulated. While significant contributions to the knowledge of organic derivatives containing unsubstituted $-\text{N}_2\text{H}_3$ groups have been made by Gher, a limited number of such hydrazides have previously been characterized in the form of N-substituted derivatives.

Related to the amides and hydrazines of the phosphoric, phosphonic and phosphinic acids and their thiono analogs are a number of compounds which can be regarded as desolvation products of these classes of substances. Ammono derivatives of compounds containing the P-O-P link have in fact been quite well defined; very little is known about other condensation products, however, although several compounds containing the P-N-N-P linkage have been reported (1,5,6).

EXPERIMENTAL

A. Phenylphosphonic diamide, $\text{C}_6\text{H}_5\text{P}(\text{O})(\text{NH}_2)_2$, was prepared by the reaction of the acid chloride with liquid ammonia. The compound appears to have no basic character and is decomposed in both acidic and basic media with the simultaneous cleavage of the P-N bond.

B. Phenylphosphonothionic diamide, $\text{C}_6\text{H}_5\text{P}(\text{S})(\text{NH}_2)_2$, was also prepared by ammonolysis of the acid chloride, using liquid ammonia. The compound melts at 41°C and tends to decompose on standing.

C. Alkyl P-phenylphosphonamidates having the general formula $C_6H_5P(O)(OR)(NH_2)$ can be prepared by partial alcoholysis of phenylphosphonic diamide. The ethyl, *n*-propyl, *n*-butyl and *n*-amyl esters were synthesized.

D. Phenylphosphonic dihydrazide, $C_6H_5P(O)(N_2H_3)_2$, was prepared by treating an ester slurry of hydrazine with phenylphosphonic dichloride. This substance behaves as a typical hydrazine since it reacts with carbonyl compounds such as acetone, *p*-chloroacetophenone and *p*-methoxybenzaldehyde to yield the corresponding phenylphosphonohydrazones.

E. Phenylphosphonothionic dihydrazide was prepared in good yield by the method of Gher (1); initial indications that this compound could form salts were substantiated by the preparation of the dihydrochloride.

F. Attempts to prepare phenylphosphonic dihydrazide by the hydrazinolysis of phenylphosphonic diamide in alcoholic solution were unsuccessful. It was found, however, that partial hydrazinolysis could be accomplished if the reaction was carried out in *n*-propanol; under the proper conditions the principal product was phenylphosphonamidic hydrazide, $C_6H_5P(O)(NH_2)(N_2H_3)$, although an appreciable quantity of *n*-propyl phenylphosphonamidate, was also isolated.

The molecular formula of this unusual hydrazinolysis product was substantiated by molecular weight determination, and by iodate titration to establish the percentage of hydrazine nitrogen in the compound. This "phosphonamidrazide" reacts with acetone and *p*-methoxybenzaldehyde, thus establishing its character as a hydrazine compound.

G. The iodate titration method for the determination of hydrazine nitrogen was found to have general application for phosphoric and phosphonic acid derivatives containing the N_2H_3 group; high results are obtained in the titration of thiono compounds, however, presumably because of concomitant oxidation of the phosphorus-sulfur linkage.

H. The reaction of diphenyl phosphorohydrazidate, $(C_6H_5O)_2P(O)(N_2H_3)$, with ethyl chloroformate results in the formation of a characteristic *N*-carbethoxy derivative. This observation, together with the known fact that a similar compound is formed with phenylphosphonothionic dihydrazide, indicates that this reaction is general for hydrazides of both the phosphoric and phosphonic acids.

BIOLOGICAL TESTS

A variety of biological tests are in progress to determine the toxiphoric characteristics of various phosphorus-nitrogen compounds prepared in the course of this work. Preliminary results indicate that several of the compounds have potential pharmacological and fungicidal value but that none of them show promise as insecticides.

134 pages. \$1.68. MicA54-2851

BIBLIOGRAPHY

1. Gher, R., Thesis, Doctor of Philosophy, University of Illinois, 1952.

2. Stokes, H., Ber., 27, 565 (1894).

3. Klement, R. and Becht, K., Z. anorg. Chem., 254, 217 (1947).

4. Klement, R. and Koch, O., Angew. Chem., 65, 266 (1953).

5. Autenrieth, W. and Bolli, E., Ber., 58, 2144 (1925).

6. Ephraim, F. and Sackheim, M., Ber., 44, 3416 (1911).

THE OXIDATION OF MAGNESIUM IN PURE OXYGEN AND IN AN IODINE-OXYGEN ATMOSPHERE

(Publication No. 10,162)

Alfred Bartley Zimmerman, Ph.D.
Indiana University, 1954

The reactions of magnesium samples with pure, dry oxygen and with an iodine-oxygen atmosphere have been studied by a continuous gravimetric method. On the basis of kinetic studies and of chemical and x-ray diffraction analyses of the reaction products a mechanism is proposed to account for the role of iodine in the lowering of the activation energy of the reaction of magnesium with oxygen.

In pure oxygen at 550° C. magnesium reacted either uniformly at the rate of 0.21 mg/cm²/hr. or only at the edges of prismatic samples. These phenomena of uniform oxidation or of preferential oxidation are ascribed to the variable resistance of the initial oxide layer to the diffusion of the reactants rather than to any fundamental dissimilarities between the reactivities of the metal in different samples. Furthermore, the resistance of this initial oxide layer appears to depend upon the medium in which the abrading is done and upon the reactivities of different areas of the same sample.

No specific correlation could be found between the shape of a sample and its rate of oxidation in pure oxygen at 550° C. However, with cylindrical samples the oxidation reaction appeared to occur in two successive stages, both of which obeyed the linear oxidation law.

Many solid salts, especially the alkali and alkaline earth halides, when placed in contact with magnesium in oxygen at 550° C. accelerated the rate of reaction of the metal at those areas where the salt was in contact with the metal.

As little as 0.10 percent iodine in oxygen was found substantially to double the rate of oxidation of magnesium at 550° C. by lowering the activation energy from 50,500 calories per mole to 26,500 calories per mole. The importance of the role of iodine in accelerating the rate of oxidation of magnesium was emphasized by experiments in which each magnesium sample was oxidized first in an iodine-oxygen atmosphere and then in pure oxygen. The rate of oxidation changed from 0.39 mg/cm²/hr. in the mixed atmosphere to 0.21 mg/cm²/hr. in pure oxygen. The reaction products formed on magnesium in

the mixed atmosphere erupted violently when cooled from 550° C. to 100° C. This action further demonstrated the effect of iodine, since the oxide formed on the metal in pure oxygen did not erupt. The mechanism proposed to account for the influence of iodine involves two steps. The first step is the reaction of outward-diffusing magnesium atoms with adsorbed iodine to form magnesium iodide. The second step involves the reaction of this magnesium iodide with oxygen to form magnesium oxide and free iodine. Magnesium hypoiodite appears to be formed in the process in small amounts.

Experiments in which magnesium was exposed to pure iodine vapors at 550° C. indicated that no protective iodide film is formed on the metal at this temperature. 174 pages. \$2.18. MicA54-2852

CHEMISTRY, ORGANIC

I. COPOLYMERS AND TERPOLYMERS OF METHYLACRYLONITRILE DIMER.

II. COPOLYMERS OF SYMMETRICAL AROMATIC HYDROCARBONS

(Publication No. 9029)

William Sunley Anderson, Ph.D.
University of Illinois, 1954

PART I

Introduction

There is a widespread need for a rubber which is flexible at low temperatures and resistant to the swelling action of organic solvents. The copolymerization with butadiene of properly selected comonomers is a well-used route to elastomers with certain desired properties. Acrylonitrile, for example, yields an oil-resistant rubber when copolymerized with butadiene. A new substituted acrylonitrile, α -methylene- δ -methyladiponitrile (I), has recently been prepared by the action of heat on methylacrylonitrile.¹ When incorporated into a polymer molecule, the nitrile groups of this dimer of methylacrylonitrile should exert the usual solvent-resistance effect. The long alkyl chain of I, by reducing the symmetry of the polymer molecule, might lower its freeze point and thus give rise to a rubber which is both oil-resistant and flexible at low temperatures.

Discussion of Results

In this investigation a number of butadiene-methylacrylonitrile dimer copolymers and butadiene-acrylonitrile-methylacrylonitrile dimer terpolymers were prepared and evaluated as low-temperature and oil-resistant rubbers. As the methylacrylonitrile dimer content of these polymers is raised, oil

resistance is improved. Resistance to freezing, however, decreases with increasing dimer content. Substitution of methylacrylonitrile dimer for acrylonitrile weight for weight has little effect on freeze point and diminishes oil resistance.

Butadiene-acrylic acid copolymers possess excellent low-temperatures flexibility but are not exceptionally oil-resistant.² Butadiene-acrylonitrile-acrylic acid terpolymers were therefore prepared and evaluated. All of these terpolymers were at least equal in low-temperature properties to a standard butadiene-styrene copolymer. The expected oil resistance, however, was not achieved; a standard acrylonitrile copolymer surpasses the terpolymers in this respect.

PART II

Introduction

There are indications that some of the physical differences between natural and synthetic rubber stem from the symmetry and regularity of the natural molecule. Most of the synthetic products are prepared by the copolymerization of butadiene with unsymmetrically substituted ethylenes with the result that a high degree of asymmetry is introduced into the polymer chain. The purpose of this investigation was to find some symmetrical comonomers which could be copolymerized with butadiene, to obtain a measure of their reactivity and to prepare for evaluation large samples of copolymers from the more reactive of these symmetrical comonomers.

Discussion of Results

The high susceptibility of the meso carbon atoms of anthracene to free radical attack suggested that this readily available hydrocarbon should undergo copolymerization reactions. This supposition was confirmed by preparing copolymers with butadiene by an emulsified solution technique, freeing the product of unused anthracene, and examining the ultraviolet absorption spectrum of the copolymer. A spectrum closely resembling that of 9,10-dihydroanthracene and 9,10-dimethyl-9,10-dihydroanthracene was found for the copolymer. Anthracene thus reacts at the expected positions. That the source of the light absorption lies in the polymer itself was demonstrated by finding that the absorption intensity is not changed by repeated solution and precipitation of the polymer in organic solvents.

trans-Stilbene was copolymerized with butadiene but very low incorporations were obtained. *cis*-Stilbene has been found to be much less reactive than the *trans* isomer in agreement with the results of other workers.

No evidence could be obtained for the copolymerization of butadiene with naphthalene or phenanthrene. Calculations of free valence numbers by the molecular orbital method predict that these hydrocarbons should be less reactive than anthracene;³ this prediction was confirmed.

That fluorene, a common phenanthrene contaminant, participates in chain transfer by removal of a hydrogen atom from the methylene group has been confirmed through ultraviolet absorption measurements. Polybutadiene prepared in the presence of fluorene has an absorption spectrum in good agreement with that of fluorene and 9-methylfluorene. It is therefore clear that the methylene group is attacked in preference to the aromatic rings.

Other workers have shown that acenaphthylene may be copolymerized with butadiene. The resulting copolymer displays the stress-strain properties of a butadiene-styrene copolymer of similar composition, is more oil-resistant than the butadiene-styrene rubber, is flexible at low temperatures but is only slightly better than the butadiene-styrene standard in hysteresis properties.

Attempts to copolymerize dibiphenyleneethylene with butadiene by free radical initiation resulted in inhibition of the butadiene polymerization. The polymerization of styrene, however, is not inhibited by this hydrocarbon. The excessive resonance stabilization of the dibiphenyleneethylene radical explains its inhibitory action.

The spectral data obtained in this investigation leave no doubt that the retarding effect of polynuclear aromatic hydrocarbons is the result of actual addition of free radicals to the aromatic nucleus.

127 pages. \$1.59. MicA54-2853

1. M. J. Hogsed, U.S. Patent 2,566,203; C.A. 46, 2563 (1950).
2. C. S. Marvel, private communications through Office of Synthetic Rubber.
3. F. H. Burkitt, C. A. Coulson and H. C. Longuet-Higgins, Trans. Faraday Soc., 47, 553 (1951).

SOME STUDIES IN THE CHEMISTRY OF N-BROMOSUCCINIMIDE

(Publication No. 10,050)

Jake Bello, Ph.D.
Wayne University, 1952

In reactions with N-bromosuccinimide and dibenzoyl peroxide, methyl crotonate gave an 83% yield of methyl γ -bromocrotonate while methyl vinylacetate gave none; crotononitrile gave a 40% yield of γ -bromocrotononitrile while vinylacetonitrile gave a 13% yield of γ -bromocrotononitrile and a 21% yield of 3,4-dibromobutyronitrile. These differences were ascribed to two causes: (1) Increased reactivity of the double bond in vinylacetonitrile as compared with that in crotononitrile; (2) Decreased reactivity of the α -hydrogen atoms in vinylacetonitrile and methyl vinylacetate, as compared with those in crotononitrile and methyl crotonate, caused by the inductive effect of the adjacent cyano and carbomethoxy groups.

It was shown that certain inorganic salts, such as potassium bromide or potassium chloride, promote the addition of bromine to double bonds using

N-bromosuccinimide as a source of bromine. This was found to be true for cyclohexene, vinylacetonitrile, styrene and benzalacetone. The effect of the salt was found to be dependent on its fineness of division and on the intimacy of its mixture with the N-bromosuccinimide. It was proposed that the mode of action of the salt is the polarization, on its surface, of the carbon-carbon double bond of the olefin or of the nitrogen-bromine bond of N-bromosuccinimide, or both. Two tentative mechanisms for the reaction were presented.

It was shown that addition of bromine to the double bonds of vinylacetonitrile, styrene and cyclohexene, using N-bromosuccinimide as a source of bromine, is promoted by *p*-*t*-butylcatechol, which is widely used as a free radical chain inhibitor. It was shown that a transformation product of the inhibitor is the effective agent, by the demonstration that catechol reacts with N-bromosuccinimide to liberate bromine and is itself converted to an unknown substance.

93 pages. \$1.05. MicA54-2854

USE OF THE INTERNAL MICHAEL REACTION IN THE SYNTHESIS OF MORPHINE ANALOGUES

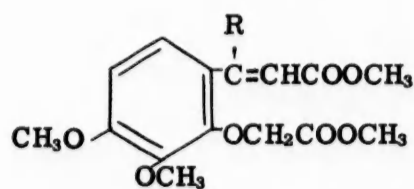
(Publication No. 10,046)

Julius John Brezinski, Ph.D.
University of Minnesota, 1953

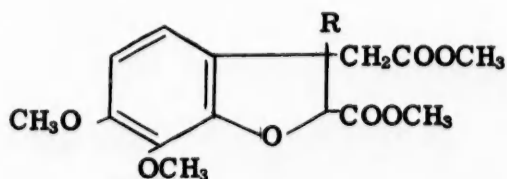
Major Advisor: C. F. Koelsch

In the first systematic study of the internal Michael reaction, Koelsch¹ showed that alkyl substitution in the α - or β -positions of esters of coumarinic acid-O-acetic acids did not inhibit the reaction. Koelsch and Stephens² later showed that this was also true of aryl substitution.

Further evidence of the generality of these findings is offered in the cyclization of methyl 3,4-dimethoxy- β -phenylcoumarinate-O-acetate (I) and the β -methyl analogue (II), to methyl 2-carbomethoxy-6,7-dimethoxy-3-phenylcoumaran-3-acetate (III) and the 3-methyl analogue (IV).

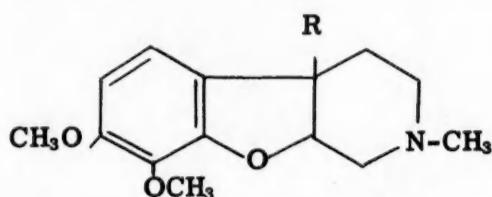


I: R = C₆H₅; II: R = CH₃



III: R = C₆H₅; IV: R = CH₃

The diesters (III) and (IV) were converted to 7,8-dimethoxy-2-methyl-4a-phenylbenzofuro[2,3-c]-1,2,3,4,4a,9a-hexahydropyridine(V) and the 4a-methyl analogue(VI) respectively. The amines, (V) and (VI),



V: R=C₆H₅ VI: R=CH₃

which are members of a new ring system, have several structural features in common with known synthetic analgesics.

The lithium aluminum hydride reduction of the precursors of (V) and (VI), the N-methyl imide of 2-carboxy-6,7-dimethoxy-3-phenylcoumaran-3-acetic acid(VII) and the N-methyl imide of the 3-methyl analogue(VIII), was effected in excellent yield and diminished time employing an ether-benzene reaction solvent.

PREPARATION OF (V): Condensation of pyrogallol with ethylbenzoylacetate yielded 72% of 7,8-dihydroxy-4-phenylcoumarin monohydrate(IX). Alkylation of (IX) with methyl sulfate furnished 71% of 7,8-dimethoxy-4-phenylcoumarin(X), m.p. 141.0-142.0°. Chloroacetic acid alkylation of (X) produced 3,4-dimethoxy-β-phenylcoumarinic acid-O-acetic acid(XI), m.p. 184.5-186.0°, which was converted without purification to (I), m.p. 90.0-92.5° (40% over-all yield based on unrecovered (X)).

Treatment of a supercooled melt of (I) with sodium methoxide gave 96% of the coumaran diester (III), m.p. 107.5-108.5°. Amination with methyl amine at 150° converted (III) (45% yield) to the N-methyl diamine of 2-carboxy-6,7-dimethoxy-3-phenylcoumarin-3-acetic acid (XII), m.p. 200.5-201.5°. Hydrolysis of (XII) with one equivalent of base led to 75% of the N-methyl half-amide (XIII), m.p. 166.5-168.0°, which in turn was readily cyclized to the N-methyl imide (VII), m.p. 133.0-134.0°, either by heat (78%) or with acetic anhydride (71%).

The addition of a benzene solution of (VII) to an equal volume of ether, in which was suspended powdered lithium aluminum hydride, followed by a two hour reflux period, formed the amine(V) in 85% yield. (V) Formed a hydrochloride, m.p. 215.0-227.0° with decomposition; a hydrobromide, m.p. 210.0-213.0° with decomposition; and a picrate, m.p. 181.0-182.5°. The pK_b of (V), as determined from the measured pH of an aqueous solution of the hydrochloride, is 6.7 ± 0.2.

PREPARATION OF VI: Following essentially the same procedures as outlined above, the following series of compounds was prepared: 7,8-dihydroxy-4-methylcoumarin(XIV), m.p. 236.0-237.0° (96% yield); 7,8-dimethoxy-4-methylcoumarin(XV), m.p. 132.0-133.0° (75%); 3,4-dimethoxy-β-methylcoumarinic acid-O-acetic acid(XVI), m.p. 176.5-177.5° and methyl 3,4-dimethoxy-β-methylcoumarinate-O-acetate(II), b.p. 174-180°/2.5 mm. (30% over-all yield based on unrecovered (XV)).

Treatment of (II) with sodium methoxide gave an 80% yield of (IV), b.p. 175-180°/ca. 1mm., m.p. 75.0-76.5°. Amination of (IV) at room temperature for six days with alcoholic methyl amine gave two isomers of N-methyl diamide of 2-carboxy-6,7-dimethoxy-3-methylcoumaran-3-acetic acid; (XVII), m.p. 159.0-160.5°, and (XVIII), m.p. 217.0-219.0° (60% total yield). Both (XVII) and (XVIII) gave the same N-methyl half-amide(XIX), m.p. 159.0-160.5°, on hydrolysis with one equivalent of base (85 and 90%). Cyclization of (XIX) to the N-methyl imide(VIII), m.p. 177.0-178.5°, was effected with heat (80%) or with acetic anhydride (77%).

The reduction of (VIII) with lithium aluminum hydride, employing an ether-benzene reaction solvent, furnished 85% of amine(VI). The latter formed a hydrochloride, m.p. 226.0-228.0° with decomposition, and a picrate, m.p. 194.5-195.5°. The pK_b of (VI), as determined from the measured pH of an exactly half-neutralized aqueous solution of the hydrochloride, is 6.0.

The hydrochlorides of (V) and (VI) have been submitted for pharmacological testing.

108 pages. \$1.35. MicA54-2855

1. Koelsch, C. F., J. Am. Chem. Soc., **67**, 569 (1945).

2. Koelsch, C. F., and Stephens, C. R., J. Am. Chem. Soc., **72**, 2209 (1950).

THE REACTION OF OXYGEN WITH ORGANOMETALLIC COMPOUNDS

(Publication No. 10,168)

Sheldon Allan Buckler, Ph.D.
Columbia University, 1954

The reaction of aryl and alkyl Grignard reagents with oxygen is well known and gives poor yields of phenols (10-22%) and good yields of alcohols (60-90%). The sequence



has been proposed for this reaction and is supported by small but significant peroxide titration values.

This reaction has been reinvestigated to provide further verification of this sequence by actual isolation of the intermediate hydroperoxide salt. If this proved possible, it would constitute a new synthesis of hydroperoxides and might provide a route to the hitherto unknown aromatic hydroperoxides. In addition, it was hoped that further information might be acquired which would shed light on the mechanism of the reaction of oxygen with these reagents.

It has been found that by slow addition of t-butyl-MgCl to oxygen-saturated ether at -75°, the hydroperoxide salt, t-butylOOMgCl, can be obtained in up to 91% yield. A developmental study indicated that the yield is greatly dependent upon the conditions of

oxidation. When the hydroperoxide salt was treated with further *t*-butylMgCl, 70% of the two moles of *t*-butyl alcohol predicted by equation (2) was obtained. These results provide final verification of the previously proposed reaction sequence.

A series of aliphatic Grignard reagents and a few other organometallic compounds were oxidized in a similar fashion, and in all cases gave the corresponding hydroperoxide after hydrolysis, the yields being 30-90%. The highly substituted reagents gave the better results. This reaction therefore constitutes a new synthesis of primary, secondary, and tertiary hydroperoxides. In addition, it was found possible to alkylate and acylate the hydroperoxide salt, thus providing a direct route to the peroxide and perester derivatives.

Several aromatic Grignard reagents were oxidized by this inverse technique, and gave only negligible peroxide titration values at room temperature. However, when these solutions were reduced at low temperatures, peroxide values of 3.0-9.3% were obtained. Arguments have been advanced to explain the apparent instability of aromatic hydroperoxides in terms of the resonance stabilization associated with aryloxy radicals. A scheme has also been proposed to explain the formation of the by-products observed in the oxidation of these reagents.

Acetylenic Grignard reagents were found to be resistant to oxidation. However, when pentynylMgBr was treated with oxygen for several hours, a small amount of *n*-valeric acid was isolated, as might be expected from the sequence observed with the aliphatic reagents.

The oxidation of the Grignard derivative of 1-bornyl chloride (apparently a mixture of bornylMgCl and isobornylMgCl) and pure bornylMgCl have been investigated. This gave a mixture of bornyl and isobornyl hydroperoxides with both reagents. This mixture was found to give 1-camphor and α -1-campholenic acid on thermal decomposition and reaction with base, the thermal decomposition being second order. The mixture of hydroperoxides decomposed rapidly in acidic solution to give traces of 1-camphor as the only isolable product.

In a competitive experiment, *t*-butylMgCl was found to react almost exclusively with oxygen in the presence of an equivalent of acetone, which was previously found to be the most reactive addend. *t*-butylMgCl gave undiminished yields of hydroperoxide in the presence of diphenylamine, a potent antioxidant. When *t*-butylMgCl was oxidized in the presence of butyraldehyde, no concurrent autoxidation of the aldehyde was observed.

These experiments seem to eliminate a radical chain mechanism from consideration. The direct reaction of the reagent with a polarized oxygen molecule may be eliminated on theoretical grounds. Three alternative mechanisms have been proposed, each proceeding by preliminary complexing of oxygen and Grignard reagent. These are internal rearrangement of the complex by either a radical or ionic process, or subsequent reaction of the complex with another molecule of Grignard reagent.

92 pages. \$1.15. MicA54-2856.

THE METALATION OF DIALKYL SULFONES

(Publication No. 9858)

Kenneth Rene Buser, Ph.D.
Purdue University, 1954

Major Professor: William E. Truce

This investigation concerns the metalation (1) of dimethyl sulfone by methylmagnesium iodide, ethylmagnesium bromide, and *n*-butyllithium. The metalated derivatives were successfully added to benzophenone and benzaldehyde to give the corresponding β -hydroxysulfones. Field and McFarland reported only a 33% yield (based on dimethyl sulfone) of adduct via methanesulfonylmethylmagnesium bromide and benzaldehyde. The low yield was attributed to dimetalation of dimethyl sulfone. However, when methanesulfonylmethylmagnesium bromide is prepared in anisole and added to benzaldehyde, a 65% yield of β -hydroxy- β -phenylethyl methyl sulfone is obtained. This product is of comparatively high purity even without recrystallization and there is little evidence of side products such as would be formed by dimetalation. The latter yield is based on benzaldehyde, which makes it difficult to make a close comparison with Field and McFarland's work as regards the effect of solvent on the reaction. However, the results do establish that there is a solvent effect in this reaction. The superiority of anisole as a solvent may be related to its intermediate basicity as compared to ether and benzene. Although a basic solvent retards the formation of the ketone-Grignard coordination complex which is a suggested intermediate in both normal and abnormal Grignard reactions, anisole and phenetole have been found to be superior to less basic solvents such as benzene as well as to more basic solvents such as ether, tetrahydrofuran, and tertiary amines. (2) The abnormal behaviour obtained in benzene is apparently due to the insolubility of the metalated derivative in this solvent. Although a precipitate of methanesulfonylmethylmagnesium bromide is observed in anisole as well as in benzene, this precipitate appears to be much more colloidal and more soluble in anisole than it is in benzene. Furthermore, a higher reaction temperature may be realized with anisole than with benzene.

The most active metalating agent was found to be *n*-butyllithium, which metalates dimethyl sulfone in benzene to give excellent yields of methanesulfonylmethylmagnesium bromide. Addition of methanesulfonylmethylmagnesium bromide to benzaldehyde gave an 85% yield of β -hydroxy- β -phenylethyl methyl sulfone. The structure of the latter was established by comparison with a sample prepared from the corresponding Grignard reagent, (1) and by dehydration to the known β -phenylvinyl methyl sulfone. (3)

Methanesulfonylmethylmagnesium iodide was prepared by metalation of dimethyl sulfone with methylmagnesium iodide. When it was prepared in benzene and treated with benzophenone, β,β -diphenyl- β -hydroxyethyl methyl sulfone was obtained in 19% yield. However, when diethyl ether was used as the

solvent, no product could be isolated. The superiority of anisole in this reaction was also demonstrated since the preparation of β , β -diphenyl- β -hydroxyethyl methyl sulfone in this solvent using methanesulfonylmethylmagnesium bromide as the addendum was accomplished in 48% yield.

When methanesulfonylmethylmagnesium was treated with benzophenone in benzene, β , β -diphenyl- β -hydroxyethyl methyl sulfone was isolated in 46% yield. Dehydration of this compound yielded β , β -diphenylvinyl methyl sulfone.

Tetrahydrothiophene-1,1-dioxide was metalated in anisole by ethylmagnesium bromide and the metalated derivative was treated with benzaldehyde to give a very poor yield (4%) of 2-(phenylhydroxymethyl) tetrahydrothiophene-1,1-dioxide.

115 pages. \$1.44. MicA54-2857

BIBLIOGRAPHY

1. L. Field and J. W. McFarland, *J. Am. Chem. Soc.*, **75**, 5583 (1953).
2. R. N. Lewis and J. R. Wright, *ibid.*, **74**, 1255 (1952).
3. W. E. Truce, J. A. Simms, and H. E. Hill, *ibid.*, **75**, 5412 (1953).

STUDIES ON HALOGENATED ACETIC ACIDS AND ESTERS

(Publication No. 9860)

Donald Lee Christman, Ph.D.
Purdue University, 1954

Major Professor: E. T. McBee

Part I

The Reformatsky reaction of ethyl bromofluoroacetate with C_6H_5CHO , $C_6H_{13}CHO$, $(CH_3)_3CCHO$, $C_7F_{15}CHO$, $CH_3CH=CHCHO$, $C_6H_5CH=CHCHO$, $C_4H_9COC_2H_5$, $CH_3COC_6H_5$, $C_6H_5COC_6H_5$, $C_6H_5CH=CHCOC_6H_5$, $(CH_3)_2C=CHCOC_6H_5$, $C_3F_7COC_2H_5$, $C_3F_7COC_6H_5$, $C_3F_7COC_3F_7$ and cyclohexanone is reported and compared to similar condensations with ethyl bromoacetate. Ethyl bromofluoroacetate reacts more sluggishly than ethyl bromoacetate in the reaction, but in most cases, comparable yields of condensation products are obtained if solvents such as toluene or xylene are used. Ethyl heptafluoropropyl ketone, heptafluorobutyrophenone and perfluoroheptanone-4 have been condensed with ethyl bromoacetate. These condensations represent a new extension of the reaction.

The isolation of ethyl acetate and ethyl fluoroacetate in a number of condensations, in which the respective bromo esters were used, can be explained by either of two possible reaction mechanisms, involving either an organometallic or an ionic intermediate. Literature evidence for the ionic intermediate is discussed.

Part II

The rates of reaction of ethyl chloroacetate, ethyl bromoacetate, ethyl bromofluoroacetate, ethyl bromochloroacetate and ethyl dibromoacetate with potassium iodide in dry acetone have been measured at 20° and 0°. The rates of reaction of potassium iodide with ethyl dichloroacetate and ethyl chlorofluoroacetate in dry acetone at 20° have also been measured. The great difference in reactivity between ethyl bromoacetate and ethyl bromofluoroacetate in this reaction is explained by a polar effect. The decreasing reactivity of ethyl bromochloroacetate and ethyl dibromoacetate toward potassium iodide is attributed to a steric effect.

Part III

The infrared absorption spectra of the ethyl esters of twelve alpha-halogenated acetic acids are compared. The carbonyl absorption band is shifted towards shorter wave lengths in the halogenated esters, the order of effect being $F > Cl > Br$. The carbonyl absorption bands of ethyl chloro-, chlorofluoro-, bromofluoro- and iodofluoroacetate occur at 5.70 μ . Ethyl fluoroacetate, ethyl dibromoacetate and ethyl bromochloroacetate show two absorption peaks in the carbonyl region. The stretching frequencies of the C-O, C-Cl and C-Br bonds in the halogenated esters are shifted successively towards higher frequencies by the second halogen atom. As expected, the order of effect of the second halogen atom on shortening these bonds is $F > Cl > Br > I$.

180 pages. \$2.25. MicA54-2858

THE NATURE AND REACTIONS OF HALOGEN ADDENDS OF THE SILVER FLUOROCARBON CARBOXYLATES

(Publication No. 9542)

George H. Crawford, Jr., Ph.D.
University of Florida, 1954

The reactions between the silver salts of the fluorocarbon carboxylic acids (S) and iodine or bromine X in inert fluorocarbon solvents and under rigorously controlled conditions were investigated. It was found that these substances react at 25-26°C. in a 1:1 equivalent ratio to give addendum complexes of the formula $(\theta COO)_2AgX$, where θ is a fluorocarbon radical. All X in excess of the 1:1 equivalent ratio is present as the free halogen. The addends containing iodine were isolated and identified. Analytical data are presented which characterize the complexes present in reaction mixtures, filtered solutions, and as the isolated solid.

(S) was found to react with pyridine in a 1:1 mole ratio to yield addends of the formula $\theta COO(Py)Ag$ which can be decarboxylated, yielding a number of fluorine-containing products. (S) reacts with phosphorus, forming fluorocarbon carboxylic acid

anhydrides in high yield. The preparation of fluorocarbon nitriles by the decarboxylation of (S) in the presence of cyanogen is described.

An improved procedure for the preparation of fluorocarbon iodides from (S) is reported. A continuous procedure for the preparation of fluorocarbon iodides from fluorocarbon carboxylic acid anhydrides is described. 85 pages. \$1.06. MicA54-2859

HETEROGENEOUS BIMOLECULAR REDUCTION II. THE EMMERT REACTION. N-ALKYL PIPERIDINES AS POTENTIAL ANALGETICS.

(Publication No. 9864)

Edward B. Dunning, Ph.D.
Purdue University, 1954

Major Professor: G. B. Backman

A series of aralkyl and aryl N-methyl-piperidyl carbinols and aralkyl N-methyl-piperidines were prepared for testing as analgetics. The bases for the preparation of these compounds were the reported activity of various substituted piperidines (Amidone, Pethidine, Ketobemidone, 2-benzylpiperidine, etc.) and the formal structural relationship of the aralkyl piperidines to morphine. The piperidyl carbinols were prepared by hydrogenation of the corresponding pyridyl carbinol hydrochlorides over platinum oxide catalyst. The aralkyl piperidines were prepared by dehydration of the corresponding pyridyl carbinols by the use of concentrated sulfuric acid and subsequent hydrogenation of the substituted vinyl pyridine. The N-methyl piperidine compounds were prepared from the corresponding piperidine compounds by the use of formaldehyde and formic acid under reflux conditions. The pyridyl compounds were prepared by the Emmert reaction, which is a co-reduction of carbonyl compounds with pyridine bases, aluminum or magnesium amalgam in the presence of mercuric chloride serving as the reducing agent.

An investigation of the Emmert reaction led to the postulation that the reaction is initiated on the carbonyl linkage, the intermediate being the carbanion resulting from a two electron transfer. This is indicated by the lack of reactivity of the reducing agent(s) on pyridine in the absence of the carbonyl compound, and also by the fact that free radicals generated in the reaction mixture by the use of alkali metals, vanadous, chromous or titanous ions, irradiation in the presence of isopropyl alcohol and hypophosphorous acid attack only the carbonyl compounds and not the pyridine bases. The attack on the pyridine base by this carbanion intermediate would result in the formation of a dihydropyridyl carbinol, which has never been isolated. Complexation of the metal ion with the hetero nitrogen is an important step since calcium reduces acetophenone to the pinacol in the presence of pyridine with no attack on the base. This is consistent with the low complexing ability of calcium ion. Since the alcohol corresponding to the

carbonyl compound used has been isolated among the products, the oxidation of the dihydropyridyl carbinol to the pyridyl compound can proceed through reduction of the carbonyl compound to the alcohol, or by air oxidation. Since pinacol is stable to base and its salts do not dissociate in solution, and since benzpinacol is unstable to base and solutions of its metallic salts are dissociated (colored solutions), the lack of reaction between pyridine and magnesium pinacolate or benzpinacolate indicates that neither the pinacolate itself or a dissociation product of the pinacolate is the reactive intermediate. Reaction between pyridine, magnesium benzpinacolate and sodium resulted in a 10% yield of the expected pyridyl carbinol, presumably by reduction of the ketyl to a carbanion and subsequent attack of the carbanion on the pyridine ring. These experiments support the postulation of an ionic mechanism for the Emmert reaction and the free radical nature of magnesium benzpinacolate in pyridine solvents.

125 pages. \$1.56. MicA54-2860

THEORETICAL STUDIES ON THE MANNICH REACTION

(Publication No. 9709)

Jack Eugene Fernandez, Ph.D.
University of Florida, 1954

A study has been made of the rate of the reaction of 2,4,6-trinitrotoluene with tetraethylmethylenediamine in toluene solution. These studies led to the conclusion that the reaction follows second order kinetics, first order with respect to each component. A mechanism has been proposed for this reaction which involves the combination of one molecule of each component to form an activated addition complex which can decompose into the Mannich base and diethylamine. The postulate of an addition complex between the trinitrotoluene and methylenediamine is substantiated by a study of the steric factors which enter into the reaction. These studies based on the theory of steric hindrance point to the methylenediamine as the necessary intermediate. Evidence has also been found which leads to the conclusion that the Mannich reaction is enhanced by high amine basicity.

The reaction of diethylamine with formaldehyde has been studied and found to lead to a 50% formation of the methylenediamine at equilibrium. Although the rate of this reaction was not studied, all indications point to its being quite high. Equilibrium is probably attained in a matter of minutes. This conclusion justifies the assumption that the rate determining step in the Mannich reaction is the reaction of the methylenediamine with the active hydrogen compound.

55 pages. \$1.00. MicA54-2861

UNSATURATED TEN-MEMBERED CARBOCYCLES

(Publication No. 9916)

Albert Goldstein, Ph.D.
Cornell University, 1954

The synthesis of 1,3-cyclodecadiene and studies of the stereospecificity of various reactions leading to the formation of cyclodecene were undertaken as part of a general program aimed at the determination of the effect of ring size on the reactions of carbocycles. In the course of this work two of the three theoretically possible isomeric forms of 1,3-cyclodecadiene were prepared. Several reactions, yielding *cis*- and *trans*-cyclodecene and mixtures of the two isomers, were studied. Procedures for the isomerization of *cis*- and *trans*-cyclodecene were also studied.

cis-cis-1,3-Cyclodecadiene was obtained by the following procedure: 2-hydroxycyclodecanone, obtained by the acyloin condensation of dimethyl sebacate, was reduced to a mixture of *cis*- and *trans*-1,2-cyclodecanediol; *cis*-1,2-cyclodecanediol was acetylated to yield *cis*-1,2-cyclodecanediol diacetate, which was, in turn, pyrolyzed at 500° to give the diene. The structure of the diene was proved by chemical and physical methods. Its infrared spectrum is notable for the absence of any absorption at about 10.2μ, the *trans* double bond region.

cis-trans-1,3-Cyclodecadiene was prepared by treating *cis*- or *trans*-1,2-cyclodecanediol with phosphorus tribromide to yield 3-bromo-*cis*-cyclodecene; this compound was converted to 3-*cis*-cyclodecenyltrimethylammonium bromide; formation of the corresponding quaternary ammonium hydroxide, followed by thermal decomposition resulted in the formation of the diene. The structure and configuration of the diene were proved by chemical and physical procedures.

The selective catalytic hydrogenation of cyclodecyne resulted in the formation of pure *cis*-cyclodecene. Pure *trans*-cyclodecene was obtainable by the Hofmann degradation, via exhaustive methylation, of cyclodecylamine, which was, in turn, formed by the reduction of cyclodecanone oxime with lithium aluminum hydride.

The thermal decomposition of both cyclodecyl acetate and cyclodecyl-S-methyl xanthate was found to yield a mixture of isomeric cyclodecenes, of which the predominant member was *trans*-cyclodecene. This result was contrary to expectations based on previous work on the pyrolysis of acetates and xanthates of classical open-chain and cyclic systems. It is in line, however, with predictions based on consideration of the spatial arrangement of atoms in molecular models.

Although it was found that both alcoholic silver nitrate and ultraviolet light were incapable of isomerizing *cis*-cyclodecene to *trans*-cyclodecene, or vice versa, the action of β-naphthalenesulfonic acid caused the formation of a mixture which contained mainly *cis*-cyclodecene. This may be taken as an indication of the greater stability of the *cis* form of cyclodecene.

An attempt to reduce cyclodecyne by the action of sodium in liquid ammonia resulted in the formation of a mixture containing cyclodecyne, 1,2-cyclodecadiene and *cis*-cyclodecene.

115 pages. \$1.44. MicA54-2862

THE STRUCTURE OF GLIOTOXIN:
ANHYDROETHIOGLIOTOXIN

(Publication No. 9795)

Lee Richard Harper, Ph.D.
Cornell University, 1954

Gliotoxin, an antibiotic principle of several different molds, contains a labile sulfur function characterized as a cyclic disulfide. Desulfurization with aluminum amalgam results in the replacement of the sulfur atoms by hydrogens and the liberation of hydrogen sulfide. The product of this reaction, designated dethiogliotoxin, appears to be closely related to gliotoxin in fundamental structure. On heating dethiogliotoxin with acid a crystalline optically active product, anhydrodethiogliotoxin, is formed in excellent yields. This compound, which corresponds to the formula $C_{13}H_{14}N_2O_3$, loses a molecule of water to give the known compound 2,3-dimethylpyrazino(1.2a)-indole-1,4-dione, obtained previously by hydriodic acid reduction of gliotoxin. Anhydrodethiogliotoxin has ultraviolet absorption characteristics similar to model 3-hydroxyindolines. On the basis of this evidence, two possible structures for anhydrodethiogliotoxin have been proposed.

The synthesis of one of these possible structures for anhydrodethiogliotoxin has been accomplished. Alkylation of methyl anthranilate with dl-N-chloroacetyl-N-methylalanine ethyl ester produces dl-o-carbomethoxyphenylglycyl-N-methylalanine ethyl ester in good yields. This compound on treatment with sodium methoxide undergoes cyclization to 10-hydroxy-2,3-dimethylpyrazino(1.2a)indole-1,4-dione. Reduction of this indole derivative could not be accomplished by catalytic hydrogenation. Sodium amalgam in neutral solution effected reduction to the desired 10, 11-dihydro compound in 25 percent yield. The product had the ultraviolet absorption characteristics expected of an indoline derivative. The analysis indicated a molecular formula $C_{13}H_{14}N_2O_3$, which corresponds to anhydrodethiogliotoxin.

The ultraviolet absorption spectrum, although similar to that of anhydrodethiogliotoxin, differs in the intensity of the minor maxima. The infrared spectra of the two compounds are very similar in the region from 2 to 7 microns. The differences in the higher wavelength region are easily within the range expected for diastereoisomers. Both compounds undergo dehydration under similar conditions to the same compound, 2,3-dimethylpyrazino(1.2a)indole-1,4-dione. The synthetic compound undergoes this transformation more readily than does anhydrodethiogliotoxin. This difference can be attributed to the ease of *trans* elimination as opposed to *cis*

elimination. The synthetic compound has been shown to undergo catalytic dehydrogenation to 10-hydroxy-2,3-dimethylpyrazino(1.2a)indole-1,4-dione. It has not been possible to perform this transformation with anhydrodethiogliotoxin because it undergoes elimination of water more readily than dehydrogenation. Since these differences are consistent with the expected stereochemical effects, the conclusion is reached that the two are structurally the same.

The proposed structure for dethiogliotoxin contains a cyclohexadiene nucleus which is demonstrated by the formation of tetrahydro-derivatives. The nature of the tetrahydro-derivatives obtained by Dutcher and Buchanan has been investigated by the isolation of the products of direct hydrogenation of dethiogliotoxin. Quantitative hydrogenation shows that at atmospheric pressure exactly two moles of hydrogen are absorbed when platinum is used as catalyst. The product of this reaction melts at 179°, but is converted to a compound melting at 207° on treatment with triethylamine. This product does not depress the melting point of Buchanan's product. Hydrogenation at higher pressures produces other substances which also appear to be tetrahydro derivatives. The conclusion is reached that these represent diastereoisomers or mixtures thereof.

The desulfurization of gliotoxin has been investigated with the aim of improving the yields of dethiogliotoxin. It has been observed that other products with ultraviolet absorption similar to dethiogliotoxin can be isolated from the aluminum amalgam desulfurization. The nature of these products has not been investigated. 72 pages. \$1.00. MicA54-2863

THE REACTION OF α -HALOACETALS WITH MERCAPTANS: SUBSTITUTION REACTIONS OF 1,2-VINYL-BISSULFIDES

(Publication No. 9615)

Jack Waugh Heberling, Jr., Ph.D.
University of Minnesota, 1954

Major Advisor: William E. Parham

The reaction of α -haloacetals with difunctional mercaptans has been found to involve rearrangements. The cyclic sulfonium salt intermediate, first proposed by Fuson, Price and Burness (J. Org. Chem., **11**, 475 (1946)) was found to explain the experimental evidence satisfactorily.

It has been found that heterocyclic systems such as 2-methoxy-1,4-oxathiane, 1,4-oxathiene, 2,3-dimethyl-1,4-oxathiene-2, 2-bromo and acetoxy-2,3-dimethyl-1,4-oxathiane and 1,4-dithiene can be prepared by reaction of the appropriate α -haloacetal or ketal with mono or dithioglycol. 2,3-Dimethyl-1,4-oxathiene-2 and 1,4-dithiene were prepared by conventional reactions for comparison purposes.

Several of the reactions and conclusions of Rothstein have been reexamined and several of Rothstein's conclusions have been found in error.

Specifically, the compound considered by Rothstein (J. Chem. Soc., 1550 (1940)) to be acrolein diethyl mercaptal has been shown to be 1,3-bisethylthio-1-propene. Rothstein's conclusions, based on the erroneous structure, have been reinterpreted.

The *cis* and *trans* forms of 1,2-bisphenylthioethylene have been synthesized and the structures established. It has been found that 1,2-bisphenylthioethylene undergoes substitution reactions, specifically the Vilsmeier reaction, in the ethylenic system. Several other vinyl sulfides have been found to undergo the reaction also. These results led to the conclusion that the aromatic character of benzo-1,4-dithiadene is, in reality, a property of 1,2-vinyl-bissulfides and is not dependent on the heterocyclic system.

The reaction of mercaptide ion with 1,2-dihaloethylenes was studied. It was found that *cis*, but not *trans*, 1,2-dichloroethylene undergoes reaction, and then only in the presence of excess alkali. Two mechanisms for these reactions were discussed.

100 pages. \$1.25. MicA54-2864

A STUDY OF THE WOLFF REARRANGEMENT

(Publication No. 10,006)

Thomas Watkins Hutton, Ph.D.
University of Washington, 1954

Several phases of the silver-catalyzed rearrangement of diazomethyl ketones to acids or acid derivatives — commonly known as the Wolff rearrangement — have been investigated. Diazoketones derived from tertiary acids have been rearranged to esters in 75% yields with the aid of ultraviolet light, the stereochemistry of the rearrangement of diazoketones derived from secondary acids has been re-investigated, and the irradiation of *t*-butyl diazomethyl ketone with ultraviolet light has resulted in the formation of α , γ -di-*t*-butyl- $\Delta^{\beta\gamma}$ -butenolide as the major product.

When diazoketones derived from tertiary acids are treated according to the commonly used conditions for effecting the Wolff rearrangement, poor yields of the desired rearranged product are frequently obtained. In order to find a more satisfactory method for effecting the rearrangement, methanolic solutions of three tertiary diazoketones (*t*-butyl, triethylcarbinyl, and methylethylisobutylcarbinyl diazomethyl ketones) were irradiated with ultraviolet light. Yields of 71-75% of the rearranged product (methyl esters) were obtained and ultraviolet light was shown to be similarly effective for rearranging diazoketones derived from secondary acids. If the diazoketones were rearranged with the usual silver catalysts, the yields were generally considerably lower, and the suggestion is made that light catalysis is more effective for rearranging sterically hindered diazoketones because there is no need for a chemical species to attack the hindered, reactive portion of the molecule. In addition to the superior

yields, the rearrangement catalyzed by light is advantageous because of the ease of carrying out the reaction and working up the reaction mixture.

Irradiation of *t*-butyl diazomethyl ketone in the absence of a solvent was shown to result in a 62% yield of α , γ -di-*t*-butyl- $\Delta^{\beta\gamma}$ -butenolide and a 13% yield of 2,2,6,6-tetramethyl-4-heptenone-3. These two products are of interest since they presumably arise from a coupling of a rearranged and unrearranged moiety of *t*-butyl diazomethyl ketone, and they are thought to originate from a reaction of *t*-butylketene with the diazoketone. Irradiation of diazoacetone failed to give a butenolide, while the irradiation of diazoacetophenone gave but a 9% yield of a di-butenolide; consequently, the photolysis of diazoketones does not appear to be a practical synthetic approach for the preparation of butenolides.

Diazoketones derived from secondary acids have been found to racemize during the silver-catalyzed Wolff rearrangement. Since the reaction takes place in a neutral medium, the use of ultraviolet light to effect the rearrangement of such diazoketones might give retention of activity. When a methanolic solution of active *sec*-butyl diazomethyl ketone was irradiated with ultraviolet light, nearly complete retention of optical activity was observed in the methyl *sec*-butylacetate. When the rearrangement of the diazoketone was catalyzed by a silver thiosulfate complex in aqueous dioxane in the presence of sodium hydroxide, by silver oxide in methanol or by silver benzoate in methanol in the presence of triethylamine, the resultant products were optically active. In fact, the products derived by means of the four different methods exhibited the same degree of retention of activity—98% (only 2% racemization)—which would lead one to suspect that the rearrangement proceeded with complete retention of activity and that the reported maximum rotations of methyl-ethylacetic and/or *sec*-butylacetic acids are in error. When methylbenzylcarbinyl diazomethyl ketone was rearranged under the same four conditions, retention of optical activity was again observed in all of the products; however, the extent of retention of activity varied slightly among the four products. From the optical activity of one of the products a value of $[\alpha]_D^{25} +2.43^\circ$ was calculated for the maximum rotation of 3-benzylbutyric acid, whereas the previously reported maximum rotation was $[\alpha]_D^{25} +1.93^\circ$.

112 pages. \$1.40. MicA54-2865

THE EFFECT OF SUBSTITUENTS IN
TRIMETHYLARYLSILANES: PART I. THE
CONJUGATIVE ABILITY OF THE TRIMETHYLSILYL
GROUP. PART II. FRIEDEL-CRAFTS ACYLATIONS
WITH TRIMETHYLSILYLBENZOYL CHLORIDES.
PART III. ELECTROPHILIC SUBSTITUTION BY
HYDROGEN IN THE XYLENES. THE KINETICS
OF ACID CLEAVAGE OF
THE TRIMETHYLSILYLXYLENES.

(Publication No. 9360)

Henry Raymond Krysiak, Ph.D.
Purdue University, 1954

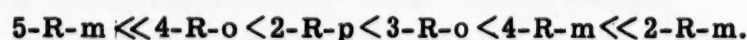
Major Professor: Robert A. Benkeser

Part I. The Conjugative Ability of the Trimethylsilyl Group. — The effect of the *m*- and *p*-Me₃Si group upon the ionization constants of anilines, dimethylanilines, phenols, and benzoic acids has been studied and the Hammett sigma values determined.

These data indicate that the *m*-Me₃Si group exerts mainly an electron-releasing inductive effect in all these reactions. The same is true of the *p*-Me₃Si group in benzoic acids. The latter group however, is capable of limited conjugation involving an expansion of the silicon valence shell in the reaction of phenols, anilines, and dimethylanilines.

Part II. Friedel-Crafts Acylations with Trimethylsilylbenzoyl Chlorides. — Successful acylations of toluene with *m*- and *p*-trimethylsilylbenzoyl chlorides and aluminum chloride have been accomplished. Similarly, anisole has been acylated with *p*-trimethylsilylbenzoyl chloride in the presence of stannic chloride. The corresponding trimethylsilylphenyl ketones were obtained in fair to good yields as the principal reaction products. No apparent cleavage of the trimethylsilyl group was detected under the reaction conditions employed. *o*-Trimethylsilylbenzoyl chloride when reacted under Friedel-Crafts conditions with anisole and with toluene, gave resinous materials as principal products. Structure proofs for all the silicon-containing ketones are described.

Part III. Electrophilic Substitution by Hydrogen in the Xylenes. The Kinetics of the Acid Cleavage of the Trimethylsilylxylenes. — Pseudo-first order rate constants for the cleavage of the six trimethylsilylxylenes by *p*-toluenesulfonic acid in aqueous acetic acid have been determined at 25°. The reactions were followed by a dilatometric method. Although the cleavage reactions parallel usual electrophilic substitution processes, they are considerably influenced by buttressing and steric strain effects. The order of increase in the rates of acid cleavage for the trimethylsilylxylenes is (R = trimethylsilyl):



A plot of the logarithms of the rate constants for the cleavage reaction against the logarithms of the partial rate factors for the corresponding positions in the xylenes yields a good linear relationship for halogenation and nitration, and a fair relationship

with other reactions. This is good supporting evidence for the formation of reaction intermediates similar to that postulated in electrophilic substitutions. 316 pages. \$3.95. MicA54-2866

THE USE OF THE PEROXIDE-CATALYZED REACTIONS OF BROMOFLUOROMETHANES IN THE PREPARATION OF OLEFINS AND DIENES CONTAINING FLUORINE

(Publication No. 9551)

Alan Mathieson Lovelace, Ph.D.
University of Florida, 1954

A study has been made of the peroxide catalyzed additions of dibromodifluoromethane and bromochlorodifluoromethane to various hydrocarbon olefins and fluoroolefins.

In most of the cases studied, simple one-to-one addition products of the type CF_2XCH_2CHBrR , where X may be chlorine or bromine, were obtained. Chloroolefins did not react with either of the difluorodihalomethanes nor did bromotrifluoromethane add to any hydrocarbon olefins.

The structures of the eighteen addition products obtained were established by chemical methods.

An explanation is offered for the experimentally determined fact that the progressive substitution of fluorine for hydrogen in ethylene leads to the formation of increasingly large amounts of two-to-one addition products.

A reaction mechanism has been offered to account for the presence of olefins in the products obtained from peroxide catalyzed additions to certain olefins.

The addition products have been converted into ten fluoroolefins and fluorobutadienes by dehydrohalogenation reactions. Three new fluorocyclopropanes have been prepared by treating certain of the adducts with zinc. 77 pages. \$1.00. MicA54-2867

A NEW APPROACH TO THE STERIC EFFECTS OF HALOGEN SUBSTITUENTS IN AROMATIC SYSTEMS

(Publication No. 9877)

Darl Hamilton McDaniel, Ph.D.
Purdue University, 1954

Major Professor: Herbert C. Brown

The equilibrium between the substituted pyridines and hydrogen ions in water provides a system in which ortho effects should be absent. Specific ortho interactions such as steric inhibition of resonance, hydrogen bonding and F-strain, which may be present in other aromatic systems are impossible or improbable in the pyridinium ions. Therefore, the deviations for ortho substituents from the linear relation

obtained between the pKa values of the substituted pyridines and the pKa values of other correspondingly substituted aromatic acids and bases provides a quantitative estimate of the ortho effect in these aromatic acids and bases. With such a quantitative estimate for the ortho effects the probable origin of the effects may be reasonably postulated. Specifically, the ortho deviations support the view of the following abnormal behavior of the halogens in the systems examined.

Benzoic Acids	Steric inhibition of Resonance
Phenylboric Acids	F-Strain in the Anion Complex
Phenols and Thiophenols	Hydrogen Bonding
Anilines	Hydrogen Bonding and F-Strain in the Anilinium ion

The F-strain present in addition compounds of the substituted pyridines may be obtained in a similar fashion. The heats of reaction of a particular Lewis acid with a series of pyridine bases are measured calorimetrically. These heats are then plotted against the pKa values of the substituted pyridines. Deviations noted for 2-substituted pyridines are interpreted as being a quantitative measure of the F-strain present in the addition compound. This procedure was applied to the addition compounds of the pyridines and diborane. The steric requirement of fluorine was found to be less than that of the methyl group while the other halogens range from approximately that of methyl to approximately that of an isopropyl group. Other data obtained in this laboratory have been used to obtain the F-strain in the pyridine-boron trifluoride addition compounds. Here, the F-strain is in the same relative order as for the pyridine-borane compounds, but the absolute magnitude of the F-strain present is almost twice as great with boron trifluoride.

The pKa values and heats of reaction of a nitrobenzene solution of the pyridines with gaseous diborane are given here.

Compound	pKa _{25°}	-ΔH _{25°}
2-Fluoropyridine	-0.44 ± 0.08	12.6 ± 0.2
2-Chloropyridine	+0.72 ± 0.03	13.2 ± 0.3
2-Bromopyridine	0.90 ± 0.05	12.8 ± 0.1
2-Iodopyridine	1.82 ± 0.02	13.7 ± 0.3
3-Fluoropyridine	2.97 ± 0.05	16.3 ± 0.1
3-Chloropyridine	2.84 ± 0.03	16.5 ± 0.1
3-Bromopyridine	2.84 ± 0.03	16.4 ± 0.1
3-Iodopyridine	3.25 ± 0.05	16.6 ± 0.2

191 pages. \$2.39. MicA54-2868

THE PREPARATION AND REACTIONS
OF CERTAIN QUARTERNARY AMMONIUM
AND RELATED COMPOUNDS

(Publication No. 9567)

Carl I. Michaelis, Ph.D.
University of Florida, 1953

Some compounds were prepared in which various groups were substituted in the para position of dibenzylamino-2-hydroxy butene-3 compounds. The hydroxy groups were then in some cases successfully converted to their corresponding 2-chloro derivatives in hope that they would be active adrenergic blocking compounds. The compounds were prepared by selecting certain electron releasing and electron attracting groups and then putting them in various positions in the molecule so as to control the rate of ethyleneimonium structure formation. This is the quality to which successful adrenergic blocking activity has been attributed. Isomers of these compounds were also attempted, but disubstituted products were attained instead of the mono derivatives. Per cent yields were obtained as would be predicted from an electronic interpretation.

Beta nitro compounds which were similar in structure to the adrenergic blocking compounds were prepared by the Mannich Reaction. Work was done to determine the mechanism of the reaction because of the large number of compounds that can be prepared by this reaction. A number of new compounds were prepared. 70 pages. \$1.00. MicA54-2869

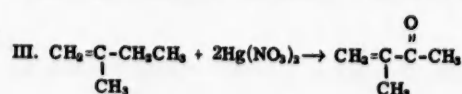
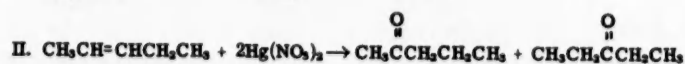
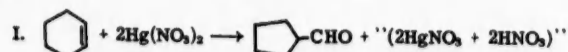
PART I. REACTION OF SUBSTITUTED ETHYLENES
WITH MERCURIC NITRATE. PART II.
PREPARATION OF SOME SUBSTITUTED
TETRAHYDROIMIDAZOLES.

(Publication No. 10,152)

Roger Earl Morris, Ph.D.
Indiana University, 1954

I. Reaction of Substituted Ethylenes with Mercuric Nitrate.

Certain alkyl substituted ethylenes were oxidized to carbonyl compounds upon treatment with solutions of mercuric nitrate in dilute nitric acid. Oxidation occurred in one of three ways; (1) with rearrangement, (2) without rearrangement, and (3) in an allyl position, according to the following illustrations.



The successfully oxidized ethylenes are given as follows (ethylene, type of oxidation, product (s), % yield

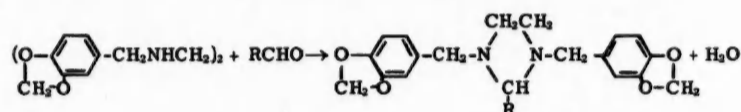
given): cyclohexene, I, cyclopentanecarboxaldehyde, 20.4; tetramethylethylene, I, pinacolone, 17; 2-pentene, II, methyl n-propyl ketone and diethyl ketone, 18.6; 3-heptene, II, di-n-propyl ketone and n-butyl ethyl ketone, 21.8; trimethylethylene, II, isopropyl methyl ketone and isopropenyl methyl ketone, 18.6; 2-methyl-1-butene, III, isopropenyl methyl ketone, 14.7. 1-Pentene and 3-methyl-1-butene gave no volatile non-mercury containing products. Aryl, or negatively substituted, ethylenes gave mercury containing products which were not investigated.

The ethylenes dissolved readily in the mercuric nitrate solution at, or near, room temperature. The reactions were generally exothermic. The products separated as an upper phase and were isolated by distillation under reduced pressure. Treatment of the ethylene (except 2-methyl-1-butene) with two moles (relative) of mercuric nitrate generally gave best results.

Cyclohexene was oxidized to 2,4,6-tricyclopentyl-1,3,5-trioxane by mercuric perchlorate, in dilute perchloric acid solution, in 4% yield.

II. Preparation of Some Substituted Tetrahydroimidazoles.

2-Substituted tetrahydroimidazoles were prepared by treating the new reagent 1,2-bis(3,4-methylenedioxybenzylamino)ethane with certain aldehydes or sugars according to the following general equation:



The following 2-substituted 1,3-bis(3,4-methylenedioxybenzyl) tetrahydroimidazoles were prepared from the corresponding aldehydes (m.p., % yield given): phenyl, 127-128°, 80; 3,4-dimethoxyphenyl, 96.5-97.5°, 83.5; 3-hydroxy-4-methoxyphenyl, 134-135°, 82.5; 4-methoxyphenyl, 131.5-132.5°, 68; 2-hydroxy-3-methoxyphenyl, 125-126°, 78; n-hexyl, 62.5-64°, 65; isopropyl, 94-95°, 85; 4-dimethylaminophenyl, 170.5-171.5°, 66.5; 2-methoxyphenyl, 113-114°, 88.8; 3,4-methylenedioxyphenyl, 155.5-156°, 70; 2-furyl, 140-141°, 80. The reactions were carried out in ethanol by mixing equimolar amounts of the reactants. Brief heating was sometimes required.

The reactions of 1,2-bis(p-methoxybenzylamino)ethane with D(-)-arabinose, and 1,2-bis(3,4-methylenedioxybenzylamino)ethane with D-mannose gave corresponding tetrahydroimidazoles in 56 and 17 per cent yields respectively. Reactions with seven other sugars, under a variety of conditions, were unsuccessful.

Treating 3,4-methylenedioxybenzaldehyde with 1,2-diaminoethane in ethanol gave 1,2-bis(3,4-methylenedioxybenzylideneamino)ethane in 97% yield; m.p. 179-180°. Catalytic hydrogenation in absolute ethanol, ethyl acetate and glacial acetic acid, using Adams Platinum Oxide Catalyst, gave good yields of 1,2-bis(3,4-methylenedioxybenzylamino)ethane. The amine of isolated as the free base (m.p. 58.5-60°), the dihydrochloride (m.p. > 300°), and the diacetate

(m.p. 134-134.5°). The salts were characterized by analysis.

The di-secondary amine was most readily isolated and stored as an acid salt. The amine was easily liberated from the dihydrochloride by treating an ethanol suspension with a slight excess of triethanolamine. Triethanolamine hydrochloride was recovered quantitatively.

108 pages. \$1.35. MicA54-2870

THE STRUCTURE OF THE PRODUCTS OF THE CONDENSATION OF THIOPHENOLS WITH FORMALDEHYDE AND SECONDARY AMINES

(Publication No. 10,087)

Mark L. Moskowitz, Ph.D.
Syracuse University, 1954

The Mannich reaction when attempted using phenols as the compound containing replaceable hydrogen atoms results in ortho and para substituted as well as di and tri substituted products. The substituting group is a dialkylaminomethyl group.¹

When thiophenols were first used in the Mannich condensation products were obtained which were assumed to be analogous to those obtained from phenols, that is, dialkylaminomethylthiophenols. This work has been done at Syracuse University and published as Master's Theses. Felton condensed p-thiocresol and the thionaphthols with formaldehyde and secondary amines and obtained products which reacted with p-nitrobenzoyl chloride to give crystalline derivatives and on this basis he assumed a nuclear reaction. Garrett used thiophenol, Greenberg used p-nitrothiophenol and m-thiocresol. Clementi used 2,5-dibromothiophenol and p-methoxythiophenol and Green used p-chlorothiophenol and p-bromothiophenol. No one but Felton reported the formation of p-nitrobenzoyl chloride derivatives.

The structure of the products of the condensation of thiophenols with formaldehyde and secondary amines has been shown to be that of a dialkylaminomethyl aryl sulfide. The evidence for this is as follows:

1. The oxidation of the p-thiocresol condensation product leads to di-p-tolyl disulfide.
2. 2,4,6-Trimethylthiophenol condenses to give products similar to those derived from other thiophenols.
3. The infrared spectra of the bases shows the absence of the peak associated with the thiol group.
4. The synthesis of the condensation product of thiophenol was performed using a method which could lead only to a dialkylaminoethyl phenyl sulfide.
5. The p-nitrobenzoyl chloride adduct of the p-thiocresol base has been shown not to be an ester by the use of the hydroxamic acid test for acid derivatives.²

95 pages. \$1.19. MicA54-2871

1. J. Decombe, *Compte. rend.*, **196**, 866 (1933); *C.A.*, **27**, 2941 (1933).

2. D. Davidson, *J. Chem. Ed.*, **17**, 81 (1940).

I. AN ATTEMPTED SYNTHESIS OF 3,4-DIMETHYLENETHIOPHANE. II. COPOLYMERIZATION OF BUTADIENE WITH FUMARONITRILE AND SUBSTITUTED ALKYL ACRYLATES.

(Publication No. 9131)

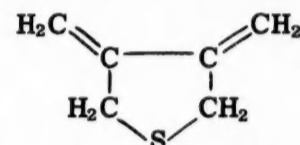
Elliott Elkington Ryder, Jr., Ph.D.
University of Illinois, 1954

I. AN ATTEMPTED SYNTHESIS OF 3,4-DIMETHYLENETHIOPHANE

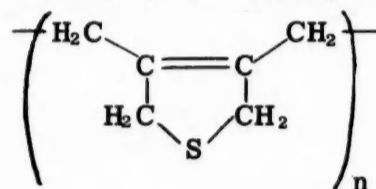
It is known that natural rubber is a head to tail polymer of isoprene in which the residual double bonds have a *cis*-configuration. (1,2) Synthetic rubber, as it is usually prepared, contains structures in which there is a large amount of *trans*-olefinic links.

This problem was undertaken in an attempt to prepare a polymer of 2,3-dimethylbutadiene in which the residual double bonds possessed a *cis*-configuration. To attain this goal, the following synthetic scheme was devised:

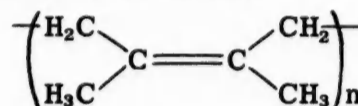
A. Synthesis of 3,4-dimethylenethiophane,



B. Preparation of poly-3,4-dimethylenethiophane,



C. Desulfurization of this polymer to give poly-*cis*-2,3-dimethylbutadiene,



The pyrolysis of 3,4-bis-(acetoxymethyl)-thiophane was carried out in an attempt to prepare 3,4-dimethylenethiophane, however the product obtained was its isomer, 3,4-dimethylthiophene. Pyrolysis in the presence of triethylamine gave the same results, hence it is indicated that an acidic thermal decomposition product of the starting material is not the agent responsible for the rearrangement. 4,5-Dimethylenecyclohexene, an isomer of o-xylene, was prepared by a similar method, (3) and it was found that pyrolysis of 4,5-bis-(acetoxymethyl)-cyclohexene mixed with 3,4-bis-(acetoxymethyl)-thiophane produced 4,5-dimethylenecyclohexene in a purity equal to that when 4,5-bis-(acetoxymethyl)-cyclohexene was pyrolyzed alone; it is therefore assumed that a free radical decomposition product is not responsible for the transformation of the desired product to 3,4-dimethylthiophene.

II. COPOLYMERIZATION OF BUTADIENE WITH FUMARONITRILE AND SUBSTITUTED ALKYL ACRYLATES

Copolymers of fumaronitrile and butadiene have been reported to be oil-resistant rubbers in one case (4) and useless nonelastic materials in another. (5) 2-Cyanoethyl methacrylate (6) and 2-nitro-2-methylpropyl methacrylate (7) are reported to impart oil resistance to polybutadiene when either is incorporated as a comonomer. Generally the presence of polar groups in polymer chains lends to them a resistance to solvents while the contribution of the polybutadiene portion imparts the ability to remain flexible at low temperatures.

This problem was undertaken in order to determine the oil-resistance and freeze-resistance of copolymers of butadiene with fumaronitrile, 2-cyanoethyl acrylate, and 2-nitro-2-methylpropyl acrylate.

Fumaronitrile was found to copolymerize rapidly with butadiene to give a heterogeneous polymer with very good low temperature properties and oil resistance and average hysteresis values. The modulus was high, the tensile strength was good, but it possessed rather poor elongations.

2-Cyanoethyl acrylate formed homogeneous copolymers with butadiene to produce a rubber with good low temperature properties, fair oil resistance, average tensile strength, and rather good hysteresis values.

2-Nitro-2-methylpropyl acrylate produced extremely elastic copolymers with butadiene which were shown to have fair low temperature properties, resistance to solvents, and tensile strength and rather good hysteresis values.

91 pages. \$1.14. MicA54-2872

BIBLIOGRAPHY

1. C. Harries, *Ber.*, **37**, 2708 (1904).
2. K. H. Meyer, *Natural and Synthetic High Polymers*, Interscience Publishers, New York, 1950, 2nd ed., p. 198.
3. W. J. Bailey, unpublished work, private communication.
4. B.I.O.S., No. 916.
5. F.I.A.T., No. 800.
6. J. Harmon and C. J. Mighton, U.S. Patent 2,379,297 (1945); C. A., **39**, 5128 (1945).
7. C. L. Agre and R. M. Leekley, U.S. Patent 2,378,169 (1945); C. A., **39**, 5556 (1945).

SOME ACID-CATALYZED REACTIONS OF ALKYL BENZENES

(Publication No. 9271)

Alfred Duane Shields, Ph.D.
Northwestern University, 1954

The effect of sulfuric acid, methanesulfonic acid, and aluminum chloride on certain phenylpentanes has been investigated. The study of optically active

2-phenylpentane, in addition to that of d,1-2-phenylpentane, 3-phenylpentane, and 1,4-di-3-pentylbenzene, afforded considerable additional information about the reactions found to occur.

Rapid sulfonation occurred when either d,1-2-phenylpentane or 3-phenylpentane was emulsified with sulfuric acid. Introduction of the sulfonic acid group apparently deactivated the molecule, as no other reaction was detectable. The only effect on optically active 2-phenylpentane of sulfonation and subsequent desulfonation was 10% racemization.

Shaking with small amounts of aluminum chloride at room temperature caused disproportionation and isomerization of 2- and 3-phenylpentane. By itself, or in benzene or toluene solution, optically active 2-phenylpentane was almost completely racemized by aluminum chloride before detectable disproportionation or isomerization occurred. The formation of d,1- from the optically active 2-phenylpentane may proceed via a chain reaction involving transfer of a hydride ion from the tertiary carbon of a 2-phenylpentane molecule to the tertiary carbon of a 2-phenyl-2-pentyl carbonium ion.

Both 2- and 3-phenylpentane were disproportionated, isomerized, and polymerized by emulsification with methanesulfonic acid at 140-150°. The racemization of optically active 2-phenylpentane occurred many times faster than isomerization. In benzene solution, however, d,1 2-phenylpentane appears to be produced only by dealkylation of optically active 2-phenylpentane and subsequent realkylation of benzene by the detached, and inactive, pentyl group. Racemization under these conditions was accompanied by some isomerization to 3-phenylpentane.

Transalkylation of pentyl groups from optically active 2-phenylpentane to toluene resulted in the formation of optically inactive pentyltoluene. The 2-phenylpentane recovered at the end of the run was only slightly racemized. It is evident that the transalkylation did not proceed by an SN_2 reaction on the carbon atom holding the phenyl group.

With either aluminum chloride or methanesulfonic acid, 2- and 3-phenylpentane were disproportionated to benzene and meta and para dipentylbenzenes. Isomerized phenylpentanes did not appear until some benzene had been formed by disproportionation. In benzene solution, isomerization was facilitated and net disproportionation slowed.

By the action of either catalyst, 1,4-di-3-pentylbenzene was dealkylated in benzene solution to form a mixture of pentylbenzenes. With aluminum chloride the composition of the mixture was approximately 70% 3-phenylpentane, 30% 2-phenylpentane. Dealkylation with methanesulfonic acid formed a mixture containing about 61% 3-phenylpentane, 32% 2-phenylpentane and 7% 2-methyl-3-phenylbutane. The equilibrium ratio of 2- and 3-phenylpentane in benzene solution as determined at 25° by catalysis with aluminum chloride is 70:30. The ratio at 145°, as determined with methanesulfonic acid, is 65:35. In the latter case some 2-methyl-3-phenylbutane is also formed.

Isomerization of 2- and 3-phenylpentane by the action of aluminum chloride or methanesulfonic acid appears to proceed by dealkylation, isomerization of

the detached pentyl group, and alkylation of benzene. This process produces two molecules of 2-phenylpentane for every molecule of 3-phenylpentane. With methanesulfonic acid, however, some of the detached pentyl groups undergo skeletal isomerization, with subsequent alkylation of benzene to produce 2-methyl-3-phenylbutane. There is no evidence for transalkylation proceeding by an SN_2 type mechanism.

110 pages. \$1.38. MicA54-2873

CHEMISTRY OF 10-PHENYLPHENANTHROL-9, PARTICULARLY ELECTROPHILIC AND NUCLEOPHILIC SUBSTITUTION

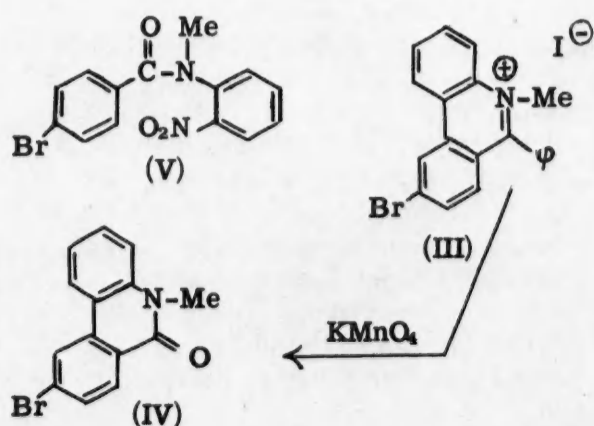
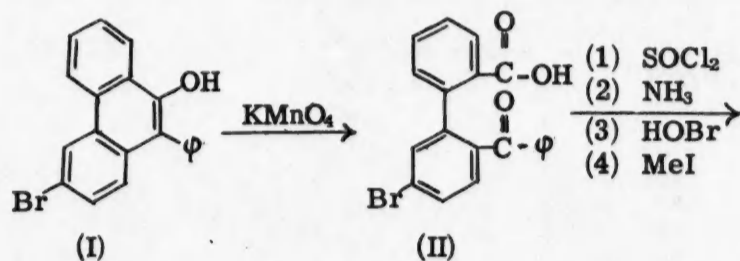
(Publication No. 10,049)

Edgar J. Smutny, Ph.D.
University of Minnesota, 1953

Major Advisor: C. F. Koelsch

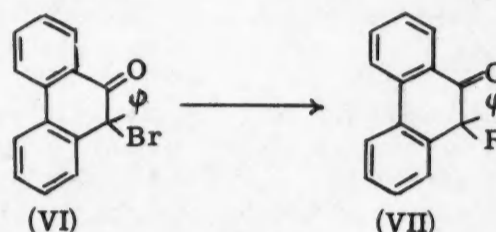
In connection with a problem having to do with the chemistry of "univalent oxygen" 10-phenylphenanthrol-9 was prepared according to the procedure of Koelsch.¹ Preliminary experiments on this compound revealed the following:

1. Bromination of 10-phenylphenanthrol-9 in acetic acid produced 3-bromo-10-phenylphenanthrol-9 (I, m.p. 183.7-184.7°). The structure of the bromo compound was proved by first oxidation to 5'-bromo-2'-benzoyl-2-biphenylcarboxylic acid (II, m.p. 166-167°). Second, when 5'-bromo-2'-benzoyl-2-biphenylcarboxamide (m.p. 184-185°) was treated with hypobromous acid 3-bromo-10-phenylphenanthridine (m.p. 153-154°) resulted. Third, oxidation of N-methyl-3-bromo-10-phenylphenanthridium iodide (III, m.p. 222-223.5°) with potassium permanganate gave



N-methyl-3-bromophenanthridone (IV, m.p. 194-195°), as one of the products. Finally this degradation product was synthesized from p-bromo-o'-nitro-N-methyl-benzanilide (V, m.p. 92-93°) by reduction of the nitro group with Raney nickel and hydrogen followed by a Pschorr cyclization.

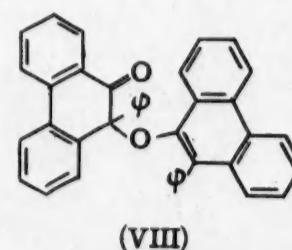
2. Bromination in absolute chloroform and γ -collidine produced 10-bromo-10-phenyl-9-keto-9,10-dihydrophenanthrene (VI, m.p. 102-103° dec.). This α -bromoketone was isomerized to (I) with HBr; it was reduced to 10-phenylphenanthrol-9 with acetone, phenol or zinc dust; it was converted to the α -alkoxyketone (VII, R = -OMe, m.p. 168-169°; R = -OEt, m.p. 116-117°) when refluxed in absolute methanol or ethanol; and it was converted to the α -acetoxyketone (VII, R = -OAc, m.p. 179-180°) when treated with silver acetate or potassium acetate in acetic acid.



3. Nitration of 10-phenylphenanthrol-9 produced the α -nitroketone (VII, R = -NO₂, m.p. 125-126° dec.). When this ketone was heated in acetic acid the α -hydroxyketone (VII, R = -OH, m.p. 118-119°; 127-129°) resulted. Similar reactions were observed with (I). Though numerous mechanisms are possible to explain the conversion of the α -nitroketone to the α -hydroxyketone, an oxidation-reduction mechanism seems the most plausible. When the α -nitroketone (VII, R = -NO₂) was refluxed in alcohol, an isomerization, possibly to 3-nitro-10-phenylphenanthrol-9 (m.p. 198-199°) occurred.

4. In an attempt to prepare 10-phenyl-9-thiophenanthrol, the conditions for a Bucherer reaction on 10-phenylphenanthrol-9 were determined.

5. Oxidation of (I) with alkaline potassium ferricyanide gave the dimeric α -phenanthroxylketone (VIII, m.p. 145-146°), the structure of which was supported by ultraviolet and infrared spectra as well as analogy with the work of Pummerer.² The compound possessed thermochromic properties in benzene or chloroform, and showed air sensitivity. Oxidation of 10-phenylphenanthrol-9 led to a phenolic dimer.



6. Infrared and ultraviolet spectra for most of the important compounds were obtained.

125 pages. \$1.56. MicA54-2874

1. C. F. Koelsch, J. Am. Chem. Soc., **55**, 480 (1934).
2. R. Pummerer and E. Cherbuliez, Ber., **52**, 1392 (1919).

**SYNTHESIS AND ATTEMPTED RESOLUTION
OF 2-(ω -CARBOXYPROPYNYL)-1,4-
DECAMETHYLENEBENZENE**

(Publication No. 9927)

Roland Edgar Stahl, Ph.D.
Cornell University, 1954

Careful examination of Fisher-Hirschfelder-Taylor models of 1,4-octamethylenebenzene and 1,4-decamethylenebenzene showed that the bridges were not free to rotate around the benzene rings because of the smallness of the bridges. It seemed that if this situation really existed in 1,4-octamethylenebenzene and 1,4-decamethylenebenzene, then the introduction of a substituent into the benzene ring of either compound would produce a racemic modification which could be resolved into its enantiomorphs.

In order to test this idea, an attempt was made to prepare 1,4-octamethylenebenzene via the acyloin ring closure of 1,4-bis-(ω -carbethoxypropyl)-benzene (I). All attempts to prepare the cyclic acyloin of I were unsuccessful. Little or no polymer, which normally accompanies the cyclic acyloin, was isolated from the reaction mixture, instead the starting ester (I) was recovered unchanged. To account for the complete inertness of the ester (I) to the acyloin reaction which utilizes finely dispersed sodium as its condensing agent, it was suggested that there might be an electronic interaction between the benzene ring and the carbon atom of the ester carbonyl group. Such an interaction would produce two six-membered rings from the side chains.

An attempt was made to prepare 1,4-bis-(ω -carbethoxypropyl)-2,5-dichlorobenzene (II) by the chlorination of I. It seemed reasonable to believe that the chlorinated ester (II) might undergo the acyloin ring closure because the chlorine atoms ought to hinder interaction between the ester groups and the benzene ring. Chlorination of the ester (I) did not place chlorine atoms in the ring exclusively; there was extensive substitution into the side chains.

From 1,4-bis-(ω -carbethoxypropyl)-benzene (I) there was prepared 1,4-bis-(ω -carbomethoxybutyl)-benzene (III) which gave the cyclic acyloin (IV) in good yield. From IV there was obtained 1,4-decamethylenebenzene.

Succinoylation of 1,4-decamethylenebenzene was successfully carried out to give 2-(ω -carboxypropionyl)-1,4-decamethylenebenzene (V).

All attempts to resolve 2-(ω -carboxypropionyl)-1,4-decamethylenebenzene (V) with brucine and strychnine failed because salt formation did not occur. Crystalline salts were formed by the acid (V) with

quinine methohydroxide and cinchonine methohydroxide; however, decomposition of these recrystallized salts gave the optically inactive acid. No optically active acid (V) could be obtained from any of the experiments.

Although the results indicate that the bridged acid (V) is non-resolvable, there is not sufficient justification for this conclusion. Because many variables are involved in any one resolution, it is not always possible to achieve the proper balance so as to resolve a mixture successfully. Several reasons may be given for the failure of this compound (V) to resolve. There is the possibility that the diastereoisomers are so similar that they fail to separate upon crystallization. Secondly, the energy of activation required for the bridge to rotate around the benzene ring may be less than the thermal energy of the molecule. This implies ease of racemization. Simultaneous stretching of the carbon-carbon bonds could increase the length of the bridge to the point where the latter could easily rotate around the benzene ring. Finally, there is the possibility that the substance is really non-resolvable implying that the models give an incorrect picture of the true molecule.

Nine new compounds were prepared in this work. They are as follows: ethyl β -[p-(ω -carbethoxypropyl)-benzoyl]-propionate, β -[p-(ω -carboxypropyl)-benzoyl]-propionic acid, 1,4-bis-(ω -carbethoxypropyl)-benzene, 1,4-bis-(ω -carboxypropyl)-benzene, 1,4-bis-(ω -hydroxybutyl)-benzene, 1,4-bis-(ω -bromobutyl)-benzene, 1,4-bis-(ω -cyanobutyl)-benzene, 1,10-(p-phenylene)-5-hydroxy-6-decanone semicarbazone, and 2-(ω -carboxypropionyl)-1,4-decamethylenebenzene.

61 pages. \$1.00. MicA54-2875

**A STUDY OF THE MECHANISM OF THE REACTION
OF PERMANGANATE WITH ALDEHYDES**

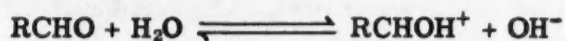
(Publication No. 10,014)

Ross Stewart, Ph.D.
University of Washington, 1954

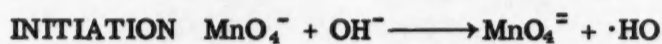
The mechanism of the reaction between aldehydes and permanganate in aqueous solution has been studied over the pH range 5 - 13. Three approaches to the problem were used. First, the kinetics of the reaction were examined over a wide pH range using benzaldehyde, seven substituted benzaldehydes, and formic acid. Second, the aldehyde hydrogen atom was replaced by deuterium in four aldehydes, benzaldehyde, piperonal, p-chlorobenzaldehyde and formic acid, and the effect of such replacement on the rate of reaction with permanganate was observed. Third, the source of oxygen in the oxidation products of benzaldehyde and formic acid were determined by the use of KMnO_4^{18} .

There are two distinct reaction paths for benzaldehyde and its derivatives. The first, which occurs in neutral and slightly acid solution, has the

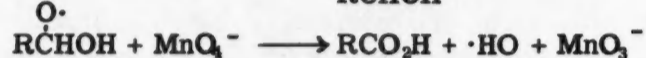
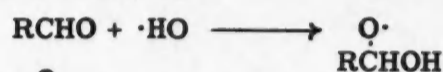
following characteristics. (1) It is subject to general acid catalysis. (2) The aldehyde hydrogen atom is probably removed as a proton in the rate controlling step since the rate of reaction of the deuterated aldehydes is about one seventh that of the ordinary aldehydes. (3) The chief source of oxygen in the oxidation product is the permanganate. (4) Substitution in the *m* or *p* position in the benzene ring produces only small changes in rate. These facts are all in agreement with the following mechanism, where B: is any base.



The second reaction path appears in basic solution and has the following characteristics. (1) The rates are vastly different for the substituted benzaldehydes, that for *p*-nitro being very fast. (2) Manganate reacts at very roughly the same rate as does permanganate with a given aldehyde. (3) The aldehyde hydrogen atom is probably removed as a hydrogen atom since the rate of reaction of the deuterated aldehydes was one half to one third that of the ordinary aldehydes. (4) The chief source of the oxygen in the oxidation product is the solvent. (5) Some aldehydes exhibit a rate roughly proportional to the square root of the hydroxyl ion concentration. These facts are in fairly good agreement with the following mechanism, involving chains.



PROPAGATION



BREAKING



The reaction of formic acid with permanganate was examined to determine the effect of replacing the aldehyde hydrogen atom with deuterium and to determine the source of the oxygen in the oxidation product, carbonate. Formic acid-*d*₁ was oxidized about one sixth to one eighth as fast as ordinary formic acid in neutral solution. The source of oxygen in the oxidation product, carbonate, was partly the permanganate and partly the solvent. It was shown that manganate reacts slowly with formic acid in basic solution. These results are discussed in terms of mechanism. 114 pages. \$1.43. MicA54-2876

CHEMISTRY, PHYSICAL

THE POLAROGRAPHIC REDUCTION OF NITROBENZENE AND BENZOPHENONE IN ALCOHOL SOLUTIONS

(Publication No. 9856)

Perce W. Bolmer, Ph.D.
Purdue University, 1954

Major Professor: Thomas De Vries

The polarographic reduction of nitrobenzene and benzophenone was carried out in neutral, unbuffered solutions of lithium chloride in the aliphatic alcohols from methanol through butanol. Liquid junction potentials were eliminated by the use of a silver-silver chloride reference electrode.

A maximum occurred on the current-voltage curves for nitrobenzene in all of the solvents except methanol. The maximum was eliminated by the addition of small amounts of ethyl cellulose, which spread the curve into two waves as its concentration was increased. The height of each wave was proportional to the concentration of nitrobenzene, and the total current represented a six electron reduction to aniline. The relative height of Wave II to Wave I was a function of solvent and temperature. The height of Wave I was controlled by a rate of reaction, but the second was diffusion controlled.

The half-wave potential of the first wave was constant with increasing concentration of both ethyl cellulose and nitrobenzene, but the second wave showed a negative shift with increasing concentration of ethyl cellulose. The shift of half-wave potential of the second wave was a function of solvent. The shift was negative in methanol and ethanol, zero in propanol, and positive in the higher alcohols. This has been accounted for qualitatively by considering the effect of increased concentration of nitrobenzene on the proton activity at the electrode.

The shift in half-wave potential was found to be a function of the logarithm of the dielectric constant, and was six times greater for the second wave than for the first.

The plot of applied potential against the logarithm of $(i_d - i)/i$ was a straight line for the first wave, and the values of $n\alpha$, calculated from its slope, were very nearly one in all of the solvents. The second wave gave a hyperbolic plot if the potential were plotted against a logarithmic function, which was modified for the increased basicity at the electrode. The values of $n\alpha$, from the slope of the asymptotes of the hyperbola were from 1.1 to 1.2 in the normal alcohols, and somewhat greater in the secondary alcohols.

Benzophenone was reduced in methanol, ethanol, propanol and isopropanol. Its wave height, which had a maximum at high concentrations of benzophenone, was not proportional to the concentration of benzophenone, but fell off for the higher concentrations. The relative decrease in height was postulated as due to the increase in basicity at the electrode,

since the direct addition of base to the solutions also reduced the wave height.

The half-wave potential variations for benzophenone were similar to those of the second wave of nitrobenzene.

The plot of potential against the logarithm of $(i_d - i)/i$ was a straight line in isopropanol with a value of $n\alpha$ of 1.24. The plot in methanol was a straight line at low concentrations, and a hyperbola at high concentrations of benzophenone, with $n\alpha$ equal to 0.92. The plots in ethanol and propanol were hyperbolas, with values of $n\alpha$ very close to one.

It is proposed that in unbuffered solutions, a suitable interpretation of current-voltage curves can be made if the increase in basicity at the electrode is considered.

160 pages. \$2.00. MicA54-2877

PHYSICO-CHEMICAL PROPERTIES OF THE ELECTRIC DOUBLE LAYER ON PLANAR SURFACES

(Publication No. 9734)

Gerard Hendrik Bolt, Ph.D.
Cornell University, 1954

An analysis of the classical Gouy-Chapman theory of the electric double layer on planar surfaces shows that in the derivation of this theory several factors have been neglected. These factors are:

1. Electrostatic interaction between the counterions,
2. changes in the dielectric constant of the medium in the double layer due to dielectric saturation phenomena,
3. polarization energy of the counterions,
4. short-range repulsion forces between the counterions.

A corrected double layer theory was developed, in which all four factors mentioned above could be introduced simultaneously. The differences between the corrected theory and the Gouy theory were calculated for a number of cases. The results of this calculation showed that in the case of colloidal particles with a fixed surface density of charge the differences between both theories are reasonably small as long as the surface density of charge does not exceed $1.5 \times 10^{-7} \text{ me/cm}^2 (14 \mu\text{C/cm}^2)$.

The factors 3. and 4. give rise to so-called "specific ion" effects, the magnitude of these effects being determined mainly by the size of the hydrated ion. In practice one manifestation of these effects appears in the preferential adsorption of certain ions. An estimate of the magnitude of these effects was given.

Some emphasis was placed upon the implications of the double layer theories for the study of clay-water systems. It was shown that actual measurements of the positive and negative adsorption of ions and of the osmotic pressure of clay (illite) suspensions were in complete agreement with the values predicted by the theory.

A compression apparatus was designed for the

measurement of the osmotic pressure of clay suspensions (covering a range from 0.1 to 100 atm.).

A theory was developed for the flocculation of clay suspensions. It could be shown that under the prevailing conditions van der Waals forces were not responsible for the attraction between the particles of a flocculated clay suspension. The suggestion, given in the literature, that the presence of positive edge-charges on the clay plates may explain flocculation phenomena in clay suspensions, was strongly supported by the experimental data obtained.

105 pages. \$1.31. MicA54-2878

AN ELECTRON DIFFRACTION INVESTIGATION OF THE MOLECULAR STRUCTURES OF METHYL CYANIDE, TRIFLUOROMETHYL CYANIDE, 1,1-DICHLOROETHANE, AND CYCLOOCTANE

(Publication No. 9862)

Merlin Dale Danford, Ph.D.
Purdue University, 1954

Major Professor: R. L. Livingston

The molecular structures of methyl cyanide, trifluoromethyl cyanide, 1,1-dichloroethane and cyclooctane have been studied by electron diffraction, using carefully purified compounds. Both the visual correlation and radial distribution procedures have been employed, with qualitative aid by the sector method in the studies of 1,1-dichloroethane and cyclooctane. In all cases, results obtained from the radial distribution and correlation procedures are in good agreement.

The structure of methyl cyanide was studied because conflicting results on this molecule had been obtained by electron diffraction and microwave spectroscopy; a reliable value for the C-C distance was necessary for comparison with the corresponding distance in trifluoromethyl cyanide. The results obtained for the C-C and C-N distances in the present investigation, $1.465 \pm 0.02 \text{ \AA}$ and $1.55 \pm 0.03 \text{ \AA}$ respectively, are in excellent agreement with the microwave determination.

The C-F distance in trifluoromethyl cyanide is of interest in connection with the structure of the CF_3 group when attached to various other groups in compounds of the type CF_3X . A microwave study of this compound has yielded $\text{C-C} = 1.46 \pm 0.02 \text{ \AA}$ and $\text{C-F} = 1.33 \pm 0.015 \text{ \AA}$, with the C-N distance assumed to be 1.158 \AA and the angle FCF assumed to be 108° . The parameters obtained in the present investigation are $\text{C-F} = 1.33 \pm 0.02 \text{ \AA}$, $\text{C-C} = 1.505 \pm 0.06 \text{ \AA}$, $\text{C-N} = 1.55 \pm 0.66 \text{ \AA}$ and $\angle \text{FCF} = 108 \frac{1}{2} \pm 1 \frac{1}{2}^\circ$. The result for the C-C distance obtained by electron diffraction is not in very close agreement with that obtained by microwave spectroscopy, but a combination of the parameters obtained most accurately by electron diffraction (C-F and F--F distances) with the microwave values for the moments of inertia of the trifluoromethyl cyanide molecule leads to $\text{C-C} = 1.475 \text{ \AA}$,

in much better agreement with the microwave value.

The structure of cyclooctane was studied in order to determine the normal configuration of this molecule at room temperature. Five possible forms of the eight-membered ring were investigated, namely, the tub, chair, crown, cradle and butterfly forms. Agreement with the diffraction data is obtained with a crown type structure with $C-C = 1.55 \pm 0.03 \text{ \AA}$ and $\angle C-C-C = 116^\circ$, but neither the tub or chair form alone gives agreement with the data. The possibility of tautomeric equilibrium between the tub, chair and crown forms was also investigated. Cradle and butterfly forms were not considered because theoretical intensity curves for these forms were so completely different from the experimental curve. The results indicate that tautomeric equilibrium is a definite possibility, with not less than 60% of the mixture consisting of the crown form, with the remainder consisting of the tub or chair forms, or any combination of these.

An unusually short C-C distance obtained for 1,2-dichloroethane (1.49 \AA), both by electron diffraction and by an X-ray diffraction investigation of the solid, led to the investigation of the structure of 1,1-dichloroethane, in an attempt to determine if any difference exists between the C-C distances in 1,1-dichloroethane and 1,2 dichloroethane, and to compare the C-Cl distance with the corresponding distance in other chloroalkanes. The parameters obtained for 1,1-dichloroethane in this investigation are $C-Cl = 1.795 \pm 0.02 \text{ \AA}$, $C-C = 1.55 \pm 0.07 \text{ \AA}$, $\angle C-C-Cl = 110^\circ \pm 4^\circ$, and $Cl-Cl = 2.925 \pm 0.03 \text{ \AA}$. Unfortunately, the C-C distance is not determined precisely enough for comparison with the same distance in 1,2-dichloroethane, and further work with the rotating sector will be necessary to determine this distance more precisely. The C-Cl distance is higher than that reported for most other chloroalkanes, with the exception of tertiary butyl chloride and 1,2-dichloropropane. Values for the $\angle C-C-Cl$ and $\angle Cl-C-Cl$ ($110^\circ \pm 4^\circ$ and $109\frac{1}{2}^\circ \pm 1\frac{1}{2}^\circ$ respectively) are about the same as those obtained for most other chloroalkanes.

141 pages. \$1.76. MicA54-2879

APPLICATION OF RAOULT'S LAW TO TERNARY MIXTURES

(Publication No. 9176)

David John Fischer, Ph.D.
University of Missouri, 1954

The partial pressures and the activity coefficients were determined in the following binary systems; chloro benzene and n-butyl chloride, chloro benzene and carbon tetrachloride, and carbon tetrachloride and n-butyl chloride. As dilute solutions of the components, except in two cases, were approached, maximum values of the activity coefficient were

obtained showing that Henry's Law was being obeyed. The exceptions, as the result of not being able to measure low enough compositions, were n-butyl chloride in the n-butyl chloride-carbon tetrachloride system and carbon tetrachloride in the chloro benzene-carbon and tetrachloride system.

All three binary systems exhibit positive deviations from Raoult's Law. The positive deviations in the n-butyl chloride-carbon tetrachloride system give rise to a maximum total pressure at an approximate composition of 19 per cent n-butyl chloride.

The partial pressures and the activity coefficients were determined in ternary mixtures of the above components. In all cases the activity coefficients of the ternary components approached their corresponding values in the binary system when one of the components was made very dilute.

Positive deviations were present in all ternary mixtures of the components. The degree of positive deviations, of course, depended upon the composition. In the dilute composition range of chloro benzene and approximate compositions of 19 and 81 per cent n-butyl chloride and carbon tetrachloride, a series of maximum total pressures existed.

170 pages. \$2.13. MicA54-2880

THE MEASUREMENT OF VAPOR PRESSURES AND MOLECULAR WEIGHTS OF VAPORS AT HIGH TEMPERATURES

(Publication No. 9866)

Robert David Freeman, Ph.D.
Purdue University, 1954

Major Professor: Alan W. Searcy

To facilitate the investigation of high-temperature, vapor-phase molecular species, the Torsion method for measuring vapor pressures, and the Knudsen-Torsion method as developed by Volmer¹ for the determination of the molecular weights of vapors has been adapted for measurements in the 1200 - 2200°K range through use of radio frequency induction heating. The Torsion method involves measurement of the angle ϕ through which the Torsion cell is rotated by the effusion of vapor through holes of areas a_1 and a_2 at distances q_1 and q_2 from the axis of suspension of the cell to a fine wire with Torsion constant D . The pressure P_T is given by $P_T = 2D \phi / (q_1 a_1 + q_2 a_2) f$. The factor f which corrects the apparent pressure for the collimating and retarding effect of tubular effusion holes, is derived and values are calculated for holes with length to radius ratios between 0 and 2.0. If, at the same time, the weight loss w per unit time from the cell is determined, the vapor pressure P_K may be calculated by the Knudsen method, $P_K = w(2\pi RT/M)^{1/2} / (a_1 + a_2) k$. R is the gas constant, T and M are the absolute temperature and molecular weight of the effusing vapor, and k is the Clausing factor which corrects the apparent pressure for the retarding effect of tubular

effusion holes. If P_K and P_T disagree by more than experimental error, the value assumed for M in the calculation of P_K must be in error, and the apparent molecular weight M^* is given by $M^* = M(P_K/P_T)^2$. If more than one molecular species is effusing, M^* is an average molecular weight determined by

$$M^* = (N_1 M_1^{1/2} + N_2 M_2^{1/2} + \dots + N_n M_n^{1/2})^2,$$

in which N_n and M_n , for example, are the mole fraction and the molecular weight of the n^{th} species.

Using graphite Torsion cells and tungsten Torsion wire in a water-cooled, evacuated, Pyrex system, the vapor pressures of tin, germanium, and silver in the 10^{-6} - 10^{-4} atm. range, and the molecular weights of their vapors, were determined. In agreement with mass spectrometric data, tin and germanium vapors were found to be essentially monatomic. However, the observed vapor pressure of each was appreciably lower than the accepted literature values. The heat of sublimation at 298°K , calculated by combining the vapor pressure data with entropy, enthalpy, and heat capacity data, is, for tin, 71.9 ± 2.0 kcal., and, for germanium, 91.5 ± 3.0 kcal. Agreement between ΔH_{298}° values calculated from Knudsen pressure data and from Torsion pressure data is excellent.

The vapor pressure of silver obtained by the Torsion method is consistently lower than that obtained by the Knudsen method. Calculations indicate an apparent molecular weight of 260 ± 84 for silver vapor at 1350°K . Recent and, at present, unpublished mass spectrometric investigations by M. C. Michel, in which the ratios of the concentrations of the thermal ions $\text{Ag}^+:\text{Ag}_2^+:\text{Ag}_3^+:\text{Ag}_4^+$ were found to be 15:7:30:1, confirm the presence of polyatomic species in silver vapor. These molecular weight results are in conflict with the work of Stern² on the thermal velocity of silver atoms and of Stern and Gerlach³ on the directional quantization of the atomic magnetic moment in an inhomogeneous magnetic field. Their results indicate, by implication, that silver vapor is predominantly monatomic. The discrepancy probably results from the insensitivity to the presence of polyatomic species of their method of collecting and detecting invisible deposits of silver on glass plates. If such is the case, the validity of their results and interpretations for silver atoms need not be questioned. The lower limit for the heat of sublimation of silver to atoms at 298°K is 70.2 ± 1.5 kcal.

154 pages. \$1.93. MicA54-2881

1. M. Volmer, *Z. physik, Chem.*, Bodenstein Festband, 863 (1931).

2. O. Stern, *Z. Physik*, **2**, 49 (1920); *ibid.*, **3**, 417 (1920).

3. W. Gerlach and O. Stern, *Z. Physik*, **9**, 349, 353 (1922).

THE IRRADIATION OF POLYETHYLENE

(Publication No. 8186)

Charles David Keeling, Ph.D.
Northwestern University, 1954

Polyethylene subjected to irradiation in the Argonne National Laboratories Heavy Water pile gradually loses hydrogen gas to form a new unsaturated polymer which possesses cross-linked carbon chains. At least 18% of the new chemical bonds formed on irradiation are cross links. The proportion of cross links may be considerably higher but is probably less than 50%. The rest of the new chemical bonds formed are double bonds, mainly at non-terminal positions along the carbon chains. The disappearance of a small concentration of initially present non-terminal double bonds is explained by assuming that irradiation, although its primary effect is to produce ions, produces free radicals which readily migrate along the hydrocarbon chains, shifting terminal double bonds which they encounter to more stable non-terminal positions. Free radicals are also postulated to explain the other chemical effects of irradiation. Cross-links and double bonds are believed to result from the combination of free radicals to form new chemical bonds, combination in the first instance occurring between adjacent chains, in the second instance along a single chain.

A viscometer is described which was designed especially for the present investigation to allow accurate viscosity measurements to be made on solutions of polyethylene at elevated temperatures.

A method of determining unsaturation by absorption of bromine vapour is applied to polyethylene and the results compared with an independent estimation of unsaturation based on infrared absorption spectra. Cross-linking is estimated from the amount of insoluble polymer found when irradiated polyethylene is extracted with toluene at the boiling point of the solvent.

Infrared absorption measurements are used wherever possible to interpret the structural changes which occur on irradiation.

174 pages. \$2.18. MicA54-2882

THERMODYNAMIC CONSIDERATIONS OF PROTEIN REACTIONS

(Publication No. 9761)

Michael Laskowski, Jr., Ph.D.
Cornell University, 1954

The thermodynamics of protein reactions are considered in terms of a model containing intramolecular hydrogen bonds between the side chain polar R groups of the amino acid residues of the protein. A quantitative treatment of modified reactivity of polar groups is given for this model involving the use of equilibrium constants for the formation of hydrogen bonds. Approximate values of these constants are

obtained by evaluation of the entropy and enthalpy of formation of an internal hydrogen bond in a protein. The entropy of formation is estimated by considering the effect of the hydrogen bond upon the rotational degrees of freedom of the side chain donor and acceptor groups. The enthalpy of formation is estimated by considering the generally accepted values to be modified by effects due to these rotational degrees of freedom. This treatment is applied here to the ionization of polar groups involved in several different kinds of hydrogen bonding situations. It is shown that the ionization constants can be increased or decreased by the presence of the hydrogen bonds to an extent quite different from that normally attributed to electrostatic effects. It is thus possible to explain the abnormal spreading and steepening of some titration curves without introducing such concepts as inaccessibility of reactive groups, or gross unfolding of the protein molecule. Rather, the reduced, or enhanced, reactivity may be attributed to thermodynamic effects arising from the presence of the hydrogen bonds. Another application of this treatment is made to the problem of the binding of small molecules or ions to proteins by considering that the small molecule or ion can compete with, say, a polar R group acceptor for the polar R group donor as a binding site. These competitive effects considerably modify the behavior normally attributed to statistical and electrostatic effects. With this model it is possible to account for some of the abnormal dependence of binding constants on the amount of unbound material, and also for the phenomenon of "all or none" binding, without requiring unfolding of the protein molecule. 78 pages. \$1.00. MicA54-2883

skew arrangement (structure IIb), and (d) a model original with this dissertation and which has a C_{2v} point-group symmetry in H_2O_2 (structure III).

For di-*t*-butyl peroxide, *t*-butyl hydroperoxide and cumene hydroperoxide the observed moments support about equally the I and III models and indicate that practically no liberation of the linkages about the O-O axis takes place. It is noted that a choice between these two structures could be made by isolation of optical isomers for these molecules, the skew model predicting their existence, the model III ruling them out. In the case of cumene hydroperoxide the assignment of bond moments brings into discussion the moment of an aromatic C-H link and the calculations based on model III lead to an assignment of the value 0.15D to that linkage (0.18D when a skew structure is regarded).

Perlauric acid shows a moment which may be explained, with only moderate success, about equally well with the III and IIb structures and with a chelate structure proposed by Giguere and Olmos for peracids.

The moment for dibenzoyl peroxide appears to be very little affected by temperature and this may indicate that its structure is rigid. Any further interpretation of the moment values must await measurements on related compounds.

The dependency of the polarization on concentration was studied in this work and has shown that the molecules of the solute peroxide are not associated at the studied concentrations.

An improved procedure has been demonstrated for the determinations and calculations in dealing with small dipole moments.

63 pages. \$1.00. MicA54-2884

THE DIPOLE MOMENTS AND STRUCTURES OF ORGANIC PEROXIDES AND RELATED SUBSTANCES

(Publication No. 8562)

Walter Lobunez, Ph.D.
University of Pennsylvania, 1954

Supervisor: John G. Miller, Ph.D.

The electric dipole moments of di-*t*-butyl peroxide, *t*-butyl hydroperoxide, cumene hydroperoxide, perlauric acid and dibenzoyl peroxide have been measured in benzene at 30° C. The moments of the di-*t*-butyl peroxide, *t*-butyl hydroperoxide and perlauric acid were also measured at 50° C. These measurements represent the first reported values for cumene hydroperoxide and perlauric acid.

The measured moments have been discussed in relation to four principal structural configurations, viz., (a) a rigid skew structure (structure I), based on the C_2 point-group model suggested for hydrogen peroxide by Penney and Sutherland, (b) a freely rotating structure with the same arrangements of atoms as in the former (structure I), (c) branched structures containing an O → O semipolar bond, the one a coplanar arrangement (structure IIa), the other a

AN APPARATUS FOR THE MEASUREMENT OF THE ABSORPTION SPECTRA OF TRANSIENT MOLECULES

(Publication No. 10,008)

John Turner Lund, Jr., Ph.D.
University of Washington, 1954

An apparatus is described for the detection and measurement of the near ultraviolet, visible, and near infrared absorption spectra of transient molecules having lifetimes of the order of milliseconds. The unique feature of the apparatus is the incorporation of a photocell detector (photomultiplier or photoconductor) in place of the extensively used photographic plate. Other features of the apparatus include: (1) applicability to the infrared spectral range where simple vibration-rotation bands may be investigated; (2) a means of distinguishing overlapping transient spectra; (3) a method of essentially eliminating the overlapping spectra of stable molecules; and (4) a simple means of obtaining the intensity of an absorption line as a function of time.

The detection system relies on a recurring concentration change of the absorbing species. After

passage through the absorption cell, the intensity of the light of spectral frequencies absorbed by the transient species has been modulated at the recurrence rate of the concentration change. The light beam is then passed through a high resolution monochromator and onto the photosensitive detector. When the monochromator is set on a transient absorption line the electrical signal obtained from the detector is of the same form as the modulation of the light beam at that frequency and circuits are described which allow this form to be plotted on a recorder. The shape of the modulated wave portrays the time-concentration dependence of the absorbing species. These circuits allow the spectra to be measured in regions inaccessible to photographic plates.

Examples of the data obtainable is given for the visible absorption spectrum of NH_2 .

72 pages. \$1.00. MicA54-2885

STUDIES IN MOLECULAR SPECTROSCOPY: THE INFLUENCE OF CORIOLIS COUPLING ON INFRARED BAND SHAPES

(Publication No. 9881)

Robert Edward Moynihan, Ph.D.
Purdue University, 1954

Major Professor: Walter F. Edgell

Edgell and May¹ and Polo² independently explained the "anomalous" band shapes in CF_3D as due to deviations from the rigid rotor, harmonic oscillator model caused by first order Coriolis perturbations. This investigation was undertaken to confirm the validity of this explanation and to establish the nature of the perpendicular band shapes for all kinds of symmetric top molecules. It has been shown that the explanation given by Edgell and May and Polo was correct. A general quantitative treatment of this problem, and a similar one for spherical top molecules, have been accomplished. These have been found to explain the major features of band envelopes in all cases where they have been applied.

The concept of band envelopes has been reexamined with special attention to the measured and computed quantities and the relations between them. Confusion concerning these points is no doubt one of the reasons that the subject of band envelopes has not been developed more fully in the past.

Relations have been derived between the coupling constants and band shapes. A table of band envelopes has been computed using an IBM card programmed digital computer. These serve at least two useful purposes. A knowledge of the expected band shapes is of use in interpreting spectra. The pronounced dependence of band shapes on the extent of coupling allow values of the coupling parameter to be obtained.

The programs developed are easily modified for a specific molecule by the initial parameters that are supplied to the computer.

The infrared spectra of several molecules have been examined in the light of this new information. Values of the coupling parameter have been obtained in this way that are in good agreement with the appropriate sum rules. These values are of importance because they are related directly to the normal coordinates of the corresponding degenerate vibrations.

A method has been derived for computing the coupling constants from theory that is simpler and uses procedures more familiar to spectroscopists than the existing methods.

The values of the coupling constants determined for BF_3 have been used to specify completely the harmonic force field. 201 pages. \$2.51. MicA54-2886

1. Edgell and May to be published. See also C. May, Ph.D. Thesis, Purdue University, June, 1953.
2. S. R. Polo, private communication.

THE SORPTION OF GASES HAVING ACIDIC AND BASIC PROPERTIES ON NYLON FIBERS

(Publication No. 10,036)

Lowell Eugene Peterson, Ph.D.
University of Minnesota, 1954

Sorption isotherms of NH_3 on nylon have been measured at 30.4° and at -31.3° . The sorption of ammonia by nylon appears to be very similar to that of water when the two are compared on a basis of the number of millimoles sorbed at corresponding relative pressures. Both water and ammonia isotherms give about the same value for the B.E.T. monolayer point.

Sorption isotherms for HCl on nylon have been measured at -78.9° , 0° , and 20° . At the lowest temperature two moles of HCl are sorbed for every mole of peptide groups in the polymer at almost zero pressure. Then sorption increases with increasing pressure until 5 molecules of HCl are sorbed per amide linkage at a relative pressure of about 0.86. At 0° and 20° nylon sorbs only one molecule of HCl per amide group at low pressures, and sorption increases quite slowly thereafter with increasing pressure. Part of the HCl which is sorbed by the polymer does not desorb when the sample is evacuated at the temperatures at which isotherms were measured.

The length of a nylon fiber first decreases and then increases with progressive sorption of HCl , while the fiber diameter swells from the beginning of sorption.

X-ray diffraction evidence indicates that an annealing process occurs when HCl is sorbed on nylon and then desorbed. This recrystallization makes it possible to put a permanent curl or crimp in nylon yarn.

Sorption isotherms of HCl on zinc insulin were measured at -78.9° and at 20° . The protein does not show the same strong affinity for HCl as does nylon. The amount of gas permanently bound by the protein on evacuation is shown to depend rather markedly on the temperature. 67 pages. \$1.00. MicA54-2887

A NEW METHOD FOR OBTAINING VAPOR-LIQUID EQUILIBRIUM DATA

(Publication No. 9209)

Rubens Sette Ramalho, Ph.D.
Vanderbilt University, 1954

An apparatus has been developed with which it is possible to reduce greatly the time required to obtain isobaric vapor-liquid equilibrium data. At present, using the previous methods, only one point in the vapor-liquid equilibrium diagram is obtained in an individual experiment making it necessary to perform a large number of individual experiments in order to obtain a complete picture of the variation over the entire range of vapor and liquid compositions. In the new apparatus, a continuous distillation is performed, which enables calculations to be made for all values of the vapor concentrations in a single experiment.

The compositions of the pot liquid throughout the distillation are obtained from a previously determined boiling-point vs. composition curve, and the corresponding distillate compositions are calculated by a material balance from the knowledge of the initial weight of material charged in the still and the weights of condensate taken during the distillation.

In the proposed method, fractionation and entrainment can be minimized as in the best of the existing methods and the "time-of-sampling error" is reduced by analyzing essentially instantaneous samples.

In the apparatus designed, a platinum resistance thermometer was used for the temperature measurements. Comparison of the data obtained with those available in the literature shows that this new method for obtaining vapor-liquid equilibrium data seems to be reliable. 136 pages. \$1.70. MicA54-2888

THE SEPARATION OF METAL OXIDES BY CLOSED SYSTEM CHLORINATION

(Publication No. 9908)

Charles Frederick Smullin, Ph.D.
Lehigh University, 1952

Deposits of high grade iron ores are available in this country, but, the presence of impurities such as chromium, nickel, and manganese render the ores unsuitable for the production of iron via the blast furnace. Since iron chloride has the lowest boiling point in relation to other common metal chlorides, the possibility of using the chlorination of the ores for separating the iron has been suggested. Further, the reversibility of the reaction to regenerate the iron oxide and chlorinating agents has been studied in a limited way. The possibility of combining the two processes and of closing the system (recycling the regenerated chlorinating agents) has not been investigated.

To ascertain the feasibility of a closed system chlorination system, a study of the reactions



and of their reversibility was undertaken within a temperature range from 1000° to 1800°F. The necessary experimental data for calculating the equilibrium constants and the other related thermodynamic information were obtained by means of a dynamic method. The method consisted of passing chlorine, oxygen and ferric chloride vapor into a chamber which was maintained at the desired temperatures. The rates of ferric oxide precipitation were plotted against various flow rates of ferric chloride and, when the curve was extrapolated to zero rate formation of ferric oxide, equilibrium conditions were determined for the reaction.

The pertinent data for the reaction of hydrogen chloride gas with ferric oxide were obtained by combining the thermodynamic values of the $\text{Cl}_2 (\text{g}) - \text{Fe}_2\text{O}_3 (\text{S})$ system with those of the fully studied "Deacon Process." The thermodynamic data (heats of reaction, heats of formation and etc.) were found to be in accord with published information and calculated theoretical values. In some cases, the experimental values are believed to be more reliable than those determined in the past.

A small pilot plant was constructed and operated to obtain additional data for the closed system process. Various ratios of hydrogen chloride and chlorine gases were used in the study to chlorinate a fluidized bed of iron oxide in a quartz reaction tower. The ferric oxide, hydrogen chloride and chlorine were regenerated in an "oxidizer" tower at the optimum temperature. Although the conversion of the ferric chloride vapor to iron oxide was lower than theoretical, the addition of steam increased the value to 90%. To dry the reagents, a suitable apparatus, which used sulfuric acid as the drying agent, was constructed and, with the pilot drying equipment, the returning vapors could be effectively dried to 0.2% residual moisture.

The optimum operating conditions to produce one ton of ferric oxide per minute are calculated and a flow diagram of the proposed closed system chlorination plant is presented.

220 pages. \$2.75. MicA54-2889

THE INTERACTION OF NON-POLAR GASES WITH SURFACES

(Publication No. 10,013)

William Arthur Steele, Ph.D.
University of Washington, 1954

The main body of literature concerning adsorption phenomena consists of studies carried out below the critical point of the adsorbate, usually in the region of the boiling point. In this region, lateral interaction, multilayer formation and possible capillary condensation must be considered. Since the theory of these phenomena is at least as difficult as the theory

of liquids, it seemed attractive to investigate behavior at higher temperatures. If the temperature is sufficiently high and the gas pressure low, interaction between gaseous molecules can be ignored, and the problem of the interaction of a single molecule with the surface investigated.

A theory will be developed which gives the total interaction of a non-polar gas with a solid. A number of simple models will be considered. It emerges that the energy of interaction can be predicted from a knowledge of the atomic polarizabilities and diamagnetic susceptibilities of the atoms involved. Also, the total interaction at a given temperature is found to be proportional to the area of the solid; thus a new method of estimating surface areas is obtained.

Experimental data will be presented which are interpreted in the light of this theory, and a short discussion of the significance of the results will be given.

85 pages. \$1.06. MicA54-2890

**STUDIES IN MOLECULAR STRUCTURE:
THE VIBRATIONAL SPECTRA OF $\text{CF}_2=\text{CD}_2$
AND $\text{CF}_2=\text{CHD}$ AND THE INFRARED
AND RAMAN SPECTRA OF CCl_3CN**

(Publication No. 9330)

Casper J. Ultee, Ph.D.
Purdue University, 1954

Major Professor: Walter F. Edgell

The Vibrational Spectra of $\text{CF}_2=\text{CD}_2$ and $\text{CF}_2=\text{CHD}$

A method has been devised to prepare $\text{CF}_2=\text{CD}_2$ and $\text{CF}_2=\text{CHD}$. The infrared spectra of the gaseous compounds and the Raman spectra of the liquid material have been determined. The observed frequencies have been assigned to the fundamental modes of vibration and overtones and combinations thereof.

The Infrared and Raman Spectra of CCl_3CN

The infrared and Raman spectra of CCl_3CN have been obtained. The observed frequencies were assigned to the fundamental modes of vibration and their overtones and combinations. A force field calculation has been carried out, using a simple valency force field supplemented with additional terms representing the interactions between the non-bonded chlorine atoms.

147 pages. \$1.84. MicA54-2891

**AN ELECTRON DIFFRACTION INVESTIGATION
OF THE MOLECULAR STRUCTURE
OF PERFLUOROTRIMETHYLAMINE
AND TRIFLUOROETHANOL**

(Publication No. 9900)

George Vaughan, Ph.D.
Purdue University, 1954

Major Professor: R. L. Livingston

The molecular structures of perfluorotrimethylamine and trifluoroethanol have been investigated by

electron diffraction using carefully purified compounds. Both the visual correlation and radial distribution procedures have been utilized in the investigation.

Previous studies of organic fluorides indicated a closest approach of fluorine atoms which are bonded to different carbon atoms of about twice the Van der Waals radius for fluorine (2.70 Å). The structure of perfluorotrimethylamine was studied in order to determine if this closest approach distance was characteristic of this compound as well. The results obtained for the structural parameters in this investigation — $\text{C-F} = 1.32 \pm 0.02$ Å, $\text{C-N} = 1.43 \pm 0.03$ Å, $\angle\text{FCF} = 108.5 \pm 2.0^\circ$, and $\angle\text{CNC} = 114 \pm 3^\circ$ — gives the closest approach of fluorine atoms bonded to different carbon atoms in perfluorotrimethylamine as 2.59 ± 0.04 Å, indicating that the value for this distance of 2.70 Å does not hold for this compound.

The structure of trifluoroethanol was investigated because of the interest in the effect of fluorine atoms on the C-C and C-O distances. The $\angle\text{FCF} = 108.5 \pm 1.5^\circ$ and $\text{C-F} = 1.34 \pm 0.02$ Å obtained in this study are in excellent agreement with the corresponding values reported for other compound containing CF_3 groups; the C-C and C-O distances were found to be 1.52 ± 0.05 Å and 1.41 ± 0.05 Å respectively. Unfortunately, the uncertainties of the data do not permit an entirely conclusive comparison of the C-C and C-O distances in this compound with the corresponding distances in ethanol and ethylene chlorohydrin, but the results indicate that these distances are probably shorter in trifluoroethanol. Within the limits of accuracy of this investigation, the CCO angle of $110 \pm 4^\circ$ in trifluoroethanol is the same as the CCO angle in ethanol.

114 pages. \$1.43. MicA54-2892

**VIBRATIONAL SPECTRA OF TRIATOMIC LINEAR
MOLECULES CONTAINING CARBON AND OXYGEN,
SULFUR, SELENIUM, OR TELLURIUM**

(Publication No. 9788)

Tunis Wentink, Jr., Ph.D.
Cornell University, 1954

The infrared absorption spectra of the linear molecules SCSe , SCTe , and CSe_2 were recorded and analyzed. The selenium compounds were studied in the gas and pure liquid phases, and in solution. Raman spectra of the liquid selenium compounds were also obtained and utilized in the analysis. The photochemically unstable tellurium compound was studied in CS_2 solution, only in the infrared. The intensity of infrared absorption at the asymmetric stretching fundamental frequency ν_3 of CSe_2 was measured for the vapor and liquid phases.

An extensive and critical literature survey of the vibrational and rotational spectra of the similar molecules CO_2 , OCS , OCSe , and CS_2 was also made. A correlation of the available data with the new data showed that in this family of molecules the stretching force constants (potential constants), based on a

Valence Force Field, for a given bond may be carried over from one molecule to another to a high degree of approximation, provided corrections are introduced for anharmonic and interaction effects between the non-bonded atoms. The carry over of the bond distances for a given atom pair in all the molecules was also demonstrated when the best values of the internuclear distances were used. Bending vibrations and force constants were also discussed.

The force constants (k 's) of the potential energy function adopted,

$$2V = \{k_1(\delta r_1)^2 + k_2(\delta r_2)^2 + 2k_3(\delta r_1\delta r_2) + k_\alpha(r\delta\alpha)^2\}, \quad (1)$$

are given in the following table:

	k_3^*	k_{CO}^*	k_{CS}	k_{CSe}	k_{CTe}	k_α^*
CO ₂	(1.264)	16.02	--	--	--	0.786
OCS	0.88 0.85	15.80	7.59	--	--	0.672
OCS _e	0.74 0.73	15.79	--	5.54	--	0.55
CS ₂	0.54 0.55	--	7.69	--	--	0.57
SCSe	0.44 0.45	--	7.54	6.00	--	0.52
CSe ₂	(0.362)	--	--	5.94	--	0.46
SCTe	0.34 0.34	--	7.40	--	4.53	0.50

*The stretching constants k_1 , k_2 , and k_3 are given in units of 10^5 dynes/cm.

The bending constants k_α are given in units of 10^{-11} dyne-cm/radian.

() Used to evaluate A and B^6 in equation (3) for k_3 .

Where double entry for k_3 is given, the first value was calculated from equation (3) and the second value from equation (2).

From the CX₂ data unambiguous values for the interaction constants (k_3) were determined. These show an inverse linear relationship between the interaction and the distance (r_{12}) between the non-bonded atoms:

$$k_3 = \frac{a}{r_{12}} - b \quad (2)$$

where $a = 6.48 \times 10^{-3}$ dynes, $b = 1.53 \times 10^5$ dynes/cm., and r_{12} is in cm. This empirical expression may be compared with a theoretical one based on a Lennard-Jones potential, proposed by Coulson et al.^{1,2}

$$k_3 = A \left[\frac{432 B^6}{r_{12}^5} \left(\frac{2B^6}{r_{12}^3} - 1 \right) \right] \quad (3)$$

where $A = -1.306 \times 10^{-12}$ erg or -0.816 eV and $B^6 = 3.695 \times 10^{-24}$ cm³, as evaluated from the k_3 and bond distances for CO₂ and CSe₂. Although the difference in the expressions is of theoretical importance, no significant difference in the results computed from equations (2) or (3) was detectable within the experimental accuracy over the available range in r_{12} .

The k for the XCZ molecules were calculated from the equations and used in conjunction with the observed fundamental frequencies and related formulae for the force constants to compute the expected isotopic shifts in ν_3 due to the replacement of carbon 12 by carbon 13 in SCSe and SCTe. These shifts agreed with those measured values for gas phase data in SCSe and CSe₂, and in dilute solutions in CS₂, SCSe, CSe₂ and SCTe.

Two consequences of the potential constant analysis of the stretching frequencies are an evaluation of the little studied C=Se force constant, and the hitherto unreported C=Te force constant. The vibrational frequencies of these seven very similar molecules should prove useful in testing alternative force fields and potential functions which may be proposed.

The value of the absolute integrated absorption intensity A , defined by $A = \int \alpha(\nu) d\nu$, for ν_3 of CSe₂ is 3.78×10^{13} cycles/cm.atm. at S.T.P. The calculated value of the "effective charge" $\frac{\partial \mu}{\partial r}$, corresponding to the above value of A , is $-4.3 \pm 0.4 \times 10^{-10}$ esu. The corresponding value of A for CSe₂ measured in CS₂ solution was significantly higher than that found for the vapor phase. However, correction of the liquid data for the dielectric effect of the solvent led to agreement with the gas value to well within the experimental error. The results indicate that further liquid-gas comparisons of intensity data for a given vibrational band are desirable for both practical and theoretical reasons. 159 pages. \$1.99. MicA54-2893

1. C. A. Coulson, J. Duchesne, and C. Manneback, "Contrib. to Molecular Spectra," Desoer, Liege (1948).

2. J. Duchesne and A. Monfils, J. Chem. Phys. 17, 586 (1949).

PROPERTIES OF THE ELECTRICAL DOUBLE LAYER ON A PLATINUM ELECTRODE

(Publication No. 10,019)

Richard Lee Wilburn, Ph.D.
University of Washington, 1954

Differential capacitance measurements have been made from -1.00 to +1.00 volts on a platinum wire electrode in 1.0 M solutions of potassium chloride, potassium nitrate, and sulfuric acid. A set of conditions has been determined which will give reasonable reproducibility of the measurements. The voltage capacity curves for the cathodic branch have been found to agree qualitatively with those obtained for dropping mercury electrodes by other authors. The negative minimum on platinum occurs at a markedly different potential than on mercury.

The voltage capacity curves are used to propose structures for the electrical double-layers at various potentials. The salient points of the structures are

as follows: (1) At potentials more negative than the negative minimum, there are two double-layers. The inner, composed of the electrode and coulombically attracted cations, and the diffuse double-layer, composed of the cation layer and the three dimensional layer of anions. (2) Polarizable solvent molecules make up the inner double-layer at the potential of the negative minimum. (3) In the potential region between the negative minimum and the maximum, there are three double-layers. The inner double-layer is composed of adsorbed anions and the electrode. The second layer, made up of coulombically attracted cations, is the Gouy layer and is probably two-dimensional. The third layer may be either a three dimensional layer of anions or a continuation of the Gouy cation layer into a three dimensional layer. (4) The maximum represents the closest approach of the adsorbed anions to the electrode. The order of capacities at the maximum may also represent the order of bond strengths of the platinum-anion pairs. (5) The decreasing capacity beyond the maximum is due to the decrease of the dielectric constant in the vicinity of the inner double-layer. The inner layer is made up of adsorbed anions in this region. (6) The positive minimum is the point at which oxide ions begin to be preferentially adsorbed. This preferential adsorption increases as the potential is made more positive.

Pseudo-capacitance versus concentration measurements were made on KI in 0.1 M sulfuric acid solution in order to determine if this method could be used as a quantitative analytical tool. A reasonably linear relationship was found between pseudo-capacity and concentration. Pseudo-capacitance versus potential measurements were also made to determine the half-wave potential for KI. The half-wave potential obtained agrees favorably with the accepted values reported using other methods.

72 pages. \$1.00. MicA54-2894

DIRECT PRODUCTION OF LARGE ORIENTED THIN SECTIONS OF A SINGLE CRYSTAL BY CONTROLLED GROWTH FROM THE VAPOR AT LOW TEMPERATURES: INFRARED ABSORPTION ANISOTROPY IN A SINGLE CRYSTAL OF BENZENE

(Publication No. 9536)

Solomon Zwerdling, Ph.D.
Columbia University, 1952

Increasing interest in the application of polarized infrared absorption spectra to the study of the crystalline state has been brought about by improved instrumentation and theoretical methods for interpreting the results obtained. At present, these studies would best be limited to those substances whose spectra of their isolated molecules are well known. Since many such substances normally exist as a vapor or a liquid, and are crystalline only at low temperature, it is a prior problem to find a method for producing crystal sections suitable for spectrometric

measurements. In this work, a general method for solving this problem is described, using a specially designed apparatus. A discussion of the growth of a single crystal of benzene and the interpretation of its infrared absorption anisotropy is also presented.

The method used for the direct growth of a thin section of a single crystal at low temperature was to develop a stable crystalline nucleus from the vapor phase in a cell of small thickness and relatively large area, and to allow its continued growth under the influence of a thermal gradient. The walls of the cell determining its thickness were made of rocksalt discs, and were secured to a nickel ring by means of high vacuum grease. The nickel ring served the further purposes of enabling the thermal gradient to be developed across the cell, of providing (through a radial hole in it) a means of access to the cell for evacuation and vapor entry, and of permitting the cell to be rigidly supported within its housing.

Since the cell had to be cooled to a very low temperature, it was mounted in an evacuated housing having rocksalt windows suitably placed to allow an infrared beam unhindered access to and egress from it. The housing was designed with a sealed-in dewar flask capable of supporting the atmospheric pressure while acting as the cold reservoir for the cell. In addition, means were provided by which the functions of electrical heating, thermocouple temperature measurements of the gradient, and evacuation of and vapor access to the cell could be performed through the wall of the evacuated housing.

For the present work, the condensible vapor was obtained from spectroscopically pure liquid benzene in a reservoir. The vapor was allowed to flow through a stainless steel capillary of appropriate bore and length into the previously evacuated and cooled cell. By varying the temperature of the reservoir, the pressure difference across the capillary was adjusted to the optimum value consistent with the production and growth of a single crystal.

In the above manner, a benzene crystal having a thickness of approximately one hundred microns and a cross-sectional area of approximately three hundred square millimeters was grown in about fifteen hours. The extinction axes of the crystal were determined in visible light with crossed Polaroids, and polarized infrared absorption spectra measured with the electric vector of the beam parallel first to one, then the other of these axes. A spectrum in unpolarized radiation was also obtained, after which the crystal was sublimed from the cell and reference spectra measured. The infrared spectrometer used was a Perkin-Elmer Model 12B, equipped with a Golay pneumatic detector. From corresponding measurements, absorption spectra were plotted as percentage transmission versus frequency, in the range from 650 to 4000 wave numbers.

An interpretation of the spectra was undertaken based on the D_{6h} point group symmetry for the isolated benzene molecule, the V_h^{15} factor group symmetry for the arrangement of the four molecules in the unit cell, and the C_i site group symmetry for each benzene molecule in the crystallographic lattice. A simplification of the interpretation was possible

since the benzene crystal belongs to the biaxial orthorhombic system. The results indicated that the infrared beam traversed the crystal parallel to the b-axis, and that the a and c-axes could each be identified with one of the known extinction axes. Absorptions due to "intrinsic" moments and to moments "induced" in the crystal were analyzed in different

orders of approximation. Splitting of frequencies due to the "static" crystal field and to site-factor group correlations were examined. Finally, the occurrence of interesting polarized structure on the envelope of the A_{2u} fundamental at 688 cm^{-1} was noted, the explanation for which was uncertain.

77 pages. \$1.00. MicA54-2895

DOMESTIC SCIENCE

THE PARTICIPATION OF GRADUATES
OF THE NEW YORK STATE COLLEGE OF HOME
ECONOMICS, CORNELL UNIVERSITY, 1911-49, IN
COMMUNITY AND PROFESSIONAL ORGANIZATIONS

(Publication No. 9792)

Ruth Helen Cook, Ph.D.
Cornell University, 1954

The central problems of this study are the determination of the nature and extent of the participation of graduates with a Bachelor's degree from the New York State College of Home Economics at Cornell University in community and professional organizations, and the relation of selected factors to this participation. Data on organizational memberships and leader positions held during a one-year period were obtained from the responses of 1138 graduates of 1911-49 to a questionnaire.

The organizational affiliations of graduates were classified into five types according to these primary purposes: professional, religious, adult education, recreational and community service. The relation of participation to size of community, time of graduation, post-bachelor study, children, and type of vocation was studied for single full-time employed, married full-time employed and married full-time homemaker graduates.

The record of participation in organizations was believed to provide some measure of the participation of these graduates as citizens and therefore, to have value for the faculty of the College whose program has preparation for citizenship as a major objective. Basic to the study are the beliefs that active, intelligent, group participation is a requisite of citizenship in a democratic society and that one of a college's important and central tasks is education for such citizenship.

Most of the home economics graduates belonged to at least one organization and held at least one leader position. Similar proportions of single and married full-time employed graduates and married full-time homemakers belonged to organizations but a higher proportion of married full-time homemakers held leader positions than of the single and married employed graduates.

All graduates averaged 3.6 memberships; they had a range in memberships from none to 17; half of them had four or more affiliations. All graduates

averaged 1.9 leader positions. Both the married full-time homemakers and married employed graduates held a higher proportion of leader positions to memberships than did the single employed graduates.

Both married and single employed graduates held their largest number of memberships in professional organizations, whereas the married full-time homemakers held their top number in community service groups. A minority of all three types of graduates held memberships in the American Home Economics Association. Single employed graduates held more recreational than community service memberships, whereas the reverse relation was true for the married employed graduates.

The less recent the time of graduation of single and married graduates and full-time homemakers, the larger the number of total memberships; community service memberships of the two married graduate group and professional memberships of the two employed graduate groups were the types of memberships showing the most variation. The presence of children was associated with more memberships for both married employed and married full-time homemaker graduates but made considerably more difference to the number of memberships of the married employed graduates. Graduates with children held more community service memberships than did graduates without children; employed mothers held more than twice as many religious memberships as the married employed graduates without children. Employment in educational, social and health vocations, post-bachelor study, and living in the smaller communities were each associated with a higher number of memberships for both the employed single and married graduates. Size of community and post-bachelor study, however, made virtually no difference to the number of memberships of the married full-time homemakers.

The findings on the participation of Cornell home economics graduates indicate the need for the College program to prepare most of its students for the citizen role of homemaker-home economists. Experiences designed to develop group member and leader skills, to provide more direct contacts with the community and the development of an integrated approach to family living problems at the community level are recommended.

182 pages. \$2.28. MicA54-2896

**EFFECTS OF THREE LEVELS OF NUTRITION
AND AGE ON THE QUALITY OF BEEF
FROM HOLSTEIN CATTLE: WEIGHT, MOISTURE,
FAT, NITROGEN, IRON, VITAMIN B₁₂, COLOR,
SHEAR FORCE, COOKING DATA
AND PALATABILITY**

(Publication No. 9797)

Marion Elma Louise Jacobson, Ph.D.
Cornell University, 1954

A study was made of the effects of three levels of nutrition on quality of beef from Holstein cattle slaughtered at several ages. Twelve bulls had been reared from the age of one week to 64 or 80 weeks, and twenty-nine heifers to 16, 32, 48, 64, or 80 weeks under controlled systems of feeding and management.

Weights, dimensions, moisture, fat, shear force (tenderness), objective color, pH, total iron, total nitrogen, and vitamin B₁₂ values were obtained on the raw meat from three stripped-out muscles from each of the 41 carcasses.

The 130 roasts were cooked from the hard-frozen state to an internal temperature of 156°F. in a 300°F. test oven. Cooking data (thawing and roasting times; weight, drip, coagulum, and evaporation losses), moisture and fat content, shear force, objective color, and palatability scores were obtained on the cooked meat.

With increase in level of nutrition the carcass weight, muscle weight, fat, iron, vitamin B₁₂, and the objective values for redness increased in the raw meat. Increase in iron content paralleled increase in a/b values (redness) of the raw meat. No change in the total nitrogen content, pH, or shear force values of the raw meat was observed with increase in level of nutrition. Moisture content of the raw meat decreased with increased nutrient intake.

With increase in age the carcass weight, muscle weight, fat, shear force, objective values for redness, iron, nitrogen, and vitamin B₁₂ content increased in the raw beef. Moisture content of the raw meat decreased with age of the animal.

Per cent weight loss, drip, coagulum, or evaporation losses during cooking of these hard-frozen roasts were not shown to be related to the nutrition of the animal.

In roasts of uniform size, per cent weight and evaporation losses did not vary consistently with age of the animal, but the losses owing to total drip and coagulum tended to decrease with age.

Although cooked to the same internal temperature, roasts of different sizes varied in doneness. In roasts cut to uniform size the doneness at the same internal temperature was comparable; nearly all were light pink over most of the cut surface.

In all the cooked roasts from the semimembranosus muscles the fat content and depth of redness increased with the level of nutrition. As in the raw meat, shear values did not vary consistently with level of nutrition. Moisture content of the cooked meat was decreased by increase in the level of feeding.

With increase of age, fat content and shear force values of the cooked meat increased regularly; redness of cooked meat from the semimembranosus muscle also increased. The cooked meat showed a small but consistent decrease in moisture content with increase in age of the animal.

According to scores of the taste panel on all the muscles, there were no consistent effects of level of nutrition upon aroma, flavor of lean, juiciness, tenderness, or color of cooked meat. However, flavor and tenderness of the longissimus dorsi muscle were apparently improved by higher levels of nutrition; also, in the meat from the heifers, the flavor of beef produced on the two higher levels of nutrition was preferred.

Age (32 to 80 weeks) apparently had a greater effect on palatability of the meat than did level of nutrition. Scores for aroma, flavor of the lean, juiciness, tenderness, and acceptability of the color decreased with age of the heifers.

150 pages. \$1.88, MicA54-2897

ECONOMICS

ECONOMICS, GENERAL

**ECONOMIC ASPECTS OF RESTRICTION OF ENTRY
INTO THE MOTOR CARRIER INDUSTRY
WITH SPECIAL REFERENCE TO INTERSTATE
COMMERCE COMMISSION POLICY**

(Publication No. 9027)

John Edward Altazan, Ph.D.
University of Illinois, 1954

The Motor Carrier Act of 1935 brought under the regulatory authority of the Interstate Commerce Commission a relatively new industry. This Act,

now known as Part II of the Interstate Commerce Act, provided the Commission with a number of important powers, one of the most important being the power to control entry into the interstate motor carrier industry. There can be little doubt that the effective utilization of this power can result in far-reaching consequences for an industry in the process of expansion.

The objective of this study has been to analyze the Interstate Commerce Commission's administration of its power of restriction of entry into the motor trucking business. It has been undertaken with a view to determining the policies which have been adopted in administering the certification

requirements of the Motor Carrier Act. Emphasis has been placed upon a determination of the extent to which the Commission has allowed a play of competitive forces in this important field.

Since one of the underlying objectives of the thesis was to determine whether or not the delegation of this authority to control entry was necessary at the time of the Act's passage, some attention has been given to the economic characteristics of the industry and the conditions which gave rise to regulation. The early chapters of the work are devoted to a study of these two subjects. This is followed by a statement of those provisions of the Motor Carrier Act pertaining to control over entry.

Following this preliminary survey, a detailed study of the various phases of entry control was made. The printed reports of Commission cases involving applications for entry into the business of interstate trucking and requests for acquisitions and consolidations of motor carrier firms were the primary sources of information for the analytical chapters of the thesis. Attention was also given to the interpretation of the provisions for exemption from Commission control under the Act and to the administration of the "grandfather" clauses, that is, the granting of certificates and permits to firms in existence at the time the Act was passed. Finally, a comparison was made between Interstate Commerce Commission policies of control and those of individual state commissions which have been granted similar powers.

Analysis of the administration of the control over entry provisions of the Motor Carrier Act has provided sufficient information to justify the conclusion that the Interstate Commerce Commission's interpretation has been in accord with the policy of Congress in providing for regulation. There have been some inconsistencies in the application of specific principles evolved in administration, but, on the whole, these have been very minor. The Commission's certification policies, though generally strict, have been less restrictive than the policies of many states in the intrastate sphere. Under no circumstances can it be said that the policy of the Interstate Commerce Commission has been to foster monopoly in motor carrier transportation. On the contrary, the Commission has used regulation as a means of supplementing rather than supplanting competition. The conditions of stability which presently exist in the interstate motor carrier industry can doubtless be attributed in great part to the Interstate Commerce Commission's administration of Part II of the Interstate Commerce Act.

295 pages. \$3.69. MicA54-2898

PRINCIPLES OF FINANCIAL ANALYSIS OF UNDERWRITING EXPENSES IN PROPERTY INSURANCE

(Publication No. 9082)

Robert Atkinson Hedges, Ph.D.
University of Illinois, 1954

The purpose of the study is to find useful methods of analyzing underwriting expenses (excluding claims expenses) as they appear in the annual reports of property insurers. Methods are sought for two uses: (1) treatment of expenses in setting rate levels; (2) evaluating the operating efficiency of an individual company.

After describing the idiosyncracies of property insurers' accounts and accounting, the study takes up the problem of determining the factors which govern the behavior of expense ratios. Deductively, it appears that about 71 per cent of the underwriting expenses vary as premium volume varies, while about 22 to 23 per cent of the expenses are independent of premium volume. (This leaves 6 to 7 per cent of expenses unclassified.)

Statistical treatment of fire insurance experience (for all stock companies entered in New York, 1944-1952) produces a set of regression equations with expenses as variables dependent upon any one or more of three independent variables: premiums written, premiums earned, and trend. Analysis indicates all three expense groups were subject to trend: Commission and Brokerage ratios declined, while the ratios for Taxes, Licenses and Fees and for "Other" Underwriting Expenses increased. All three groups were found to vary with written premiums, but only in the case of "Other" Underwriting Expenses were earned premiums significant.

The fire insurance experience of 67 stock companies during 1949-1951 provides a basis for determining the extent of, and some causes for, the variation of individual companies' ratios from those of the industry in general. Company size and relative volume of net reinsurance are found to be among the important causes of variation. (But the ratios of subsidiary companies resemble the ratios of parent companies despite size of reinsurance.)

Larger companies tend to have lower expense ratios, especially for Commission and Brokerage. The dispersion among the large companies' expense ratios is narrow, while among small companies it is very wide. Companies with relatively large reinsurance writings have lower ratios, particularly for Taxes, Licenses and Fees. Ratios of "Other" Underwriting Expenses show some relationship toward size and reinsurance, but most of their deviation is independent of both factors. (Nevertheless, "Other" Underwriting Expenses are inversely related to Commission and Brokerage.)

The results of the study have the following applications:

(1) The regression equations provide guides to the extent to which expenses can be expected to vary as rate levels vary. This furnishes a bases for treatment of the expenses in setting new rate levels (as

the thesis illustrates). The tables showing median and quartile expense ratios for companies with different size and reinsurance characteristics show the extent to which a rate level based on mean or median experience will cover the expenses of high-cost companies. (A level based on median experience plus five per cent margin for profit will cover the expenses of over sixty per cent of "small" companies.)

(2) The tables of expense ratios for companies with given characteristics provide criteria for evaluating a company against others of similar characteristics. The thesis provides several examples of how such an evaluation can be used as a guide toward the exact nature of the difficulty besetting a company with unusually bad underwriting (claims plus expenses) experience.

(3) Finally, it is noted that the methods used can be applied to any line of property insurance for which data are adequate — and that the growing body of data can be expected to supply the means of improving and refining the methods in future years.

205 pages. \$2.56. MicA54-2899

ECONOMIC EFFECTS OF SANITARY REGULATIONS RELATING TO MILK MARKETS (A STUDY IN MARKETING POLICY)

(Publication No. 10,032)

Charles Edgar Lee, Ph.D.
University of Minnesota, 1954

This study examines and evaluates the part health regulations have played in the development of today's complex milk marketing methods and the concepts that have helped to shape them. It is assumed that effective food policy depends upon efficient production and distribution; we must have both if modern technology is to be used to provide adequate diets for our population and if surpluses are to be avoided. These very desirable objectives have not been achieved; it is logical, therefore, to ask what modifications in our present concepts of sanitary milk control need to be made so that fluid milk and cream may be distributed in a more "workable" marketing structure?

The present status of sanitary regulations in the distribution of fluid milk presents dual aspects. On the one hand such regulations have made possible the tremendous growth and expansion of the modern dairy industry so important as a source of food nutrients to the people of the nation; on the other, they have been a convenient tool of those who would promote restrictive policies that prevent not only efficient production but a balanced distribution of a highly desirable food.

An obsolete system of sanitary control may well be a major cause of poor milk distribution. Examination of this hypothesis indicates that many ordinances of long standing are not well suited to the highly dynamic conditions of a technical machine economy. They should be modified by shifting the present emphasis from control of the environment to a wider use and a greater development of objective

methods and tests applied to the product itself. The latter approach would discover more readily the basic causes of contamination, initiate the changes in sanitary practice and environment necessary for their control and in doing so eliminate non-essential regulations of an artificial nature. It is maintained that the production and distribution of more and better milk would be a result.

At the producer level, a more "workable" marketing structure would follow the removal of restrictive sanitary regulations. The small farmer who can produce good milk with a limited amount of equipment would not be excluded from the market. Moreover, the market would be broadened and a greater choice of outlets would be available. A freer operation of the economics of comparative costs and the factors of supply and demand, rather than the sheltering influence of high cost environmental factors, would determine major production areas.

In the market place, the "threat of entry," that accompanies the removal of unnecessary market restrictions, would prevent abnormal margins, reduce the amount of government regulations necessary and promote research and innovation — in other words, increase the workability of the market. Economies would be passed on to the consumer in the form of lower prices, better quality of product and more services; at the same time the relative bargaining power of the farmer may be improved.

A more "workable" marketing structure in the fluid milk industry would promote policies of market extension, reciprocity, unification and simplification in the administration of sanitation regulations, to replace those of isolation, inspection-zoning and ordinance multiplication, amplification and application. Milk surplus areas need wider markets in deficit producing regions; freer operation of the law of comparative costs, new channels and competitive transportation would facilitate such commerce. Modern techniques in the processing of fluid milk — reconstituting plants, bulk transportation and cooling or freezing processes have overcome to a large extent the major obstacles of time and space. The farmers' market for fluid milk today is one of national and international interest. It rests with those who direct policy to free and facilitate the functioning of these factors.

304 pages. \$3.80. MicA54-2900

AN ANALYSIS OF THE ECONOMIC EFFICIENCY OF MINNESOTA DAIRY COOPERATIVES

(Publication No. 10,034)

Travis Warren Manning, Ph.D.
University of Minnesota, 1954

Adviser: E. Fred Koller

The purpose of this thesis was to analyze the comparative economic efficiency of Minnesota dairy marketing organizations. It undertook to test the hypothesis that cooperatives tend to be more efficient than

other dairy marketing organizations in Minnesota. The hypothesis was conditioned upon four propositions, each of which was tested by one of the following analyses: (1) the historical development of Minnesota dairy cooperatives, (2) the comparative butterfat returns to Minnesota farmers, (3) the relationship of operating efficiency to other factors, and (4) the status of competition among Minnesota dairy plants.

The analyses were based principally upon data collected by the University of Minnesota Department of Agricultural Economics in a survey of Minnesota farmers' cooperatives in 1950. Additional data were obtained from previous studies made by the University and from the records and reports of various public and private agencies.

Minnesota dairy cooperatives expanded rapidly during the 1890's. Following this period they expanded slowly but steadily, largely at the expense of other dairy organizations, particularly the centralizer creameries. This sustained growth suggested some comparative advantages in the cooperative marketing of dairy products.

Average butterfat returns to Minnesota farmers in 1949 were 1.6 cents per pound higher for cooperatives than for noncooperatives. Cooperatives paid patronage refunds averaging 1.2 cents per pound of butterfat, making a total difference of 2.8 cents. This difference would have been 4.0 cents had cooperatives handled as much whole milk proportionately as did the noncooperatives. Comparative returns paid by creameries in 1914, 1917, and 1921 showed similar contrasts. Insofar as such returns measure efficiency, these results favor cooperatives.

Operating efficiency seemed to be significantly related to type of product and volume of business in a group of highly specialized dairy cooperatives in 1949. Similar relationships were found in a group of cooperative creameries in 1934. The average output of cooperatives was considerably larger than that of noncooperatives. This probably accounted for some of the greater comparative efficiency of cooperatives.

There seemed to be more competition in selling dairy products among cooperatives than among noncooperatives, although the difference was very slight. This indicated that the higher prices paid farmers by cooperatives could not be attributed to monopoly.

Competition for butterfat varied somewhat from one area to another. Competition in some areas appeared insufficient to prevent price discrimination. Some evidence of discrimination was evident in the methods used to assess assembly charges. Most cooperatives had no reason for practicing price discrimination because their earnings belonged to the same patrons from which the butterfat was purchased. However, a noncooperative could enhance its profits by price discrimination if competitive conditions permitted.

There was little evidence of discrimination among patrons by cooperatives. Nearly all of them treated all patrons equally. However, a few appeared to discriminate against nonmembers and nondairy patrons. The tendency to treat all patrons equally caused

cooperatives to operate more competitively than noncooperatives under imperfectly competitive conditions.

Comparatively high efficiency was indicated for cooperatives by (1) the increasing preference of dairy farmers for cooperative marketing, (2) the higher returns paid by cooperatives, (3) the larger business volumes of cooperatives which were related to efficiency, and (4) the competitive propensity of cooperatives which treated all patrons equally.

121 pages. \$1.51. MicA54-2901

PUBLIC POLICY TOWARDS LABOR-MANAGEMENT RELATIONS IN LOCAL PUBLIC UTILITIES IN SELECTED STATES, 1947-1952

(Publication No. 9154)

Edward Sussna, Ph.D.
University of Illinois, 1954

In 1947, nine states passed laws which singled out public utility employees for special restrictive treatment. The laws of Florida, Indiana, Missouri, Nebraska, New Jersey, Pennsylvania, and Wisconsin prohibited strikes and provided for compulsory arbitration. The laws of Massachusetts and Virginia provided for state seizure. All the laws denied to public utility employees certain rights which are normally accorded to employees of private enterprises.

The passage of these laws was defended by the states as necessary in the public interest. The public utility concept — the notion of superimposing social control over private monopolists to protect an otherwise helpless public — was perverted into a use for which it had never been intended, namely, a weapon against labor. The laws were enacted in a period during which a great deal of labor unrest aroused much public anti-labor sentiment.

Any evaluation of the state public utility labor laws must proceed along two lines — economic and legal. An economic evaluation necessitates an analysis of the interdependence, if any, between wages paid to employees and rates charged to consumers. In general, utilities have experienced no great difficulty in obtaining rate relief from public service commissions when wages and operating expenses rose. However, between 1947 and 1952, average weekly earnings of utility employees rose less than in most other industries. This may be explained by a combination of several factors. First, utility unions are not as strongly organized as many other industrial unions. Second, the laws of 1947 weakened the bargaining position of public utility unions considerably. Finally, private owners of public utilities have feared the adverse public reaction to which regular requests for higher rates might lead. The utility owners and managers, in their fear of the public ownership movement, have sought to keep wages down. When they have had to increase wages, they have preferred to reduce costs by taking advantage of many economies which they previously had no

incentive to exploit, rather than run the risk of further antagonizing the public by consistently applying for higher rates.

The other major line along which the state public utility labor laws must be evaluated is the legal one. The severe restrictions placed on public utility employees were defended as necessary in protecting the public interest. The introduction of compulsory arbitration and the denial to public utility employees of the right to strike were part of the most restrictive legislation passed in modern labor history. Even the Taft-Hartley Act is not as restrictive and, in 1951, some of the state laws were declared unconstitutional as contravening the federal Act.

But some evidence is available on the operation of the laws between 1947 and 1952. The states were not successful in consistently forestalling work stoppages in the utilities. Also, the states have had considerable difficulty in implementing their compulsory arbitration provisions. Arbitration panels found it difficult to make exact comparisons between different utilities, because of the different demand and cost conditions in each utility.

In 1951, the Wisconsin law was declared unconstitutional by the United States Supreme Court. In rapid succession the Florida, Indiana, and Missouri laws were invalidated. Certain sections of the remaining laws have not been enforced.

In conclusion, it is apparent that the solution to labor-management problems does not simply lie in increased restrictive legislation. To some extent, labor disputes are an inseparable part of our system; they reflect the strength of a democracy. Collective bargaining and the furtherance of voluntary arbitration and no-strike agreements, possibly under government sponsorship, are considerably more in accord with long run democratic objectives than are laws which single out employees of privately owned public utilities for special restrictive treatment.

192 pages. \$2.40. MicA54-2902

ECONOMICS, COMMERCE — BUSINESS

THE DEVELOPMENT OF THE SUPERMARKET INDUSTRY THROUGH 1950 WITH EMPHASIS ON CONCOMITANT CHANGES IN THE FOOD STORE SALES PATTERN

(Publication No. 9230)

Frank J. Charvat, Ph.D.
Northwestern University, 1954

The supermarket is regarded today as an established institution vying for first place in sales among the members of the food store industry. Yet 25 years ago it was but an embryo. This dissertation examines the origin of supermarkets, why the industry grew and what changes in the food store sales pattern occurred concomitantly with its development.

Supermarkets existed prior to 1930 in the form of a few Piggly Wiggly stores and as "market stores" in the Los Angeles area. However, the California supermarkets were regarded as a regional development. Low price was not an important factor.

In 1930, a new type of supermarket developed in the East. A depression product, this "cheapy" was far different in appearance than the attractive California markets. The word "cheapy" was synonymous with price structure and appearance. Publicity in connection with this type of market focussed national attention on the supermarket.

From 1935 on, the supermarket industry gained new members at a remarkable rate and began to improve the appearance, equipment and location of its stores. This period of growth occurred in a favorable economic, technological and psychological setting. Changes in consumer buying habits, a rise in disposable income and increased use of the automobile and refrigeration were a few of the external influences present. The supermarket made greater sales gains in this favorable setting than other members of the food store industry.

Operating practices adopted by the supermarkets were examined to ascertain the reasons for such progress. Sales, gross margin, cost and profit relationships were studied. The financial factors also were examined. It was concluded that the supermarket industry adopted a wide number of practices to increase volume. It also was ascertained that gross margins had risen over those of the "cheapy"; this resulted from the practices of adding non-food lines that carried a higher markup and of offering more customer services which increased operating expenses. Whereas the earnings as a percentage of sales appeared modest, supermarkets generally have earned a large rate of return on the investment of the owner. In addition, the investment per store has mounted steadily.

Whereas the supermarket was in innovation of independent merchants, the industry received its main impetus when the large food chains joined the movement to such an extent that today they dominate the supermarket industry. The growth of the supermarket industry and the combination market class was at the expense of the limited-line stores, all of which with the exception of bakery shops and dairy product type outlets suffered losses in relative industry sales position from 1929 to 1950.

In this same period of time the combination market class (including supermarkets) increased its share of total food store sales from 31 per cent to almost 70 per cent. In turn, those combination markets which did not meet all prerequisites for supermarket classification became the leading food store retailer as to total sales. But their position is now being challenged by the supermarket, and at the current rate of growth supermarkets, despite present deterrents, should dominate the food store industry in a relatively few years.

259 pages. \$3.24. MicA54-2903

**BUSINESS FORECASTING
AND ITS FUNCTIONAL ROLE**

(Publication No. 8962)

Paul Martin Dauten, Jr., Ph.D.
Washington University, 1954

The art of business forecasting has come a long way since the present study was begun in the summer of 1947. Although its great importance as a management tool was at that time fully comprehended, there was little published material available on the subject and the need for the development of more reliable forecasting techniques was fairly generally recognized. It is to these problems that this study was addressed.

Considering the nature of the objectives, the following broad, general approach to the problem was charted: (1) to read, study, and analyze anything and everything that seemed to relate to the general topic; (2) to circularize industry in an effort to learn what techniques were being used and with what success (200 replies were received); (3) to talk personally with various businessmen and forecasting practitioners in regard to their methods of forecasting; and (4) to personally apply these techniques to the extent that time and other considerations permitted.

The introductory chapter of the resulting thesis attempts to clarify the nature of the problem, and to establish the role of business forecasting as one of the basic functions of management activity, which are described as including forecasting, planning, organizing, motivating, controlling, and adjusting.

The specific objectives of business forecasts are formulated in terms of management's problems, and criteria for determining their effectiveness are suggested.

An effort has been made in Chapter II to include an exhaustive description and critical analysis of business forecasting technique as practiced in American industry today. Methods used in forecasting overall general business conditions are particularly emphasized. The selection of techniques considered most useful in forecasting includes several methods not widely known nor previously published. One of such techniques emphasizes interest rate theory and the direction of changes in short and long-range interest levels as a forecasting device.

The concluding chapter compares present-day forecasts with those made twenty-five years ago and observes that some improvements have been made. On the other hand, forecasting has apparently been unsuccessful in adding stability to the economic activity of the country as a whole, despite the existence within the economy of numerous "built-in" stabilizers. One possible reason for this is described in some detail.

The opportunity that forecasting provides organizationally and by means of reporting procedures for knitting together the various units of the still-evolving and therefore somewhat unwieldy multi-unit form of enterprise appear to have been completely overlooked. Forecasting as an activity is by its very nature integrative and coordinational. In setting the

tempo for the entire firm's activities, forecasts in modified or untampered form can become the control force which integrates the aims and efforts of the various departments and personnel of the firm. They can serve among other things as salesmen's quotas; as a basis for the firm's flexible budgets; as an element in the firm's standard cost system; as a means of determining departmental overhead rates; as a basis for planning cash requirements; and in alternative programs of expansion or retrenchment designed to manipulate the long-run pattern of sales, costs, and profits in one's favor.

Further research suggested by the study and its rather comprehensive bibliography includes (1) an exhaustive cataloguing of all facts and factors related to the problem of forecasting general business conditions in the hope that a more general (long-lasting) theory of forecasting — and hence of the business cycle — might thereby be developed; and (2) a continuation of the investigation of the interest rate as a useful tool in forecasting, with the hope that it might be of assistance in the decision-making of policy-forming officials in business and government.

386 pages. \$4.83. MicA54-2904

**A MONTHLY INDEX
OF REGIONAL BUSINESS ACTIVITY BASED ON
NET PRODUCT MEASUREMENT**

(Publication No. 9614)

Delbert Curtis Hastings, Ph.D.
University of Minnesota, 1954

Statement of purpose: To devise a practical improved method of constructing indexes of business activity for states or other less-than-national regions. The method is proposed as an attempt to overcome weaknesses in present business activity indexes such as the following:

1. lack of definition of "business activity,"
2. lack of measurability of the concept underlying the index,
3. scaling difficulties,
4. over-dependence on particular data series,
5. lack of flexibility in adjusting to changes in the economy.

Methods and procedures: The logic and principles of measurement are first discussed; concept formation, definition for measurement, measurability, and scaling are considered in their relation to the problem of constructing a business activity index. Degree ("intensive") scales and quantity ("extensive") scales are particularly noted.

Next a wide variety of past and present indexes of business activity are scrutinized for methods of construction and for quality as business activity indicators. A variety of types of such indexes exist: business activity viewed as the state of health of the economy is contrasted to business activity viewed as the rate of use of resources; "composite" indexes

averaging data series in diverse units are contrasted to "aggregates" comprising all cases of a variable measured in the same unit and to "single series" indicators. Other classifications of business activity indexes are made also.

In the indexes studied, the definition of the concept "business activity" was rarely found to accompany the published description of each index; that is, the concept measured by or underlying the index was left unstated in most cases. Many of the indexes were found to be based on degree scales rather than quantity scales. Changes in data series and in the economy of the region of reference adversely affected many of the indexes.

The writer next presents the design of an index of business activity which attempts to overcome some of the difficulties in present indexes. The basic idea underlying the proposed index design is to adapt to the state or regional level one of the familiar aggregates which has been calculated for some time for the nation. An aggregate has several advantages as the basis of a business activity index if it is properly selected: quantitative scaling, strict definition, lack of dependence on particular component series, flexibility to meet changes. The aggregate selected as an example (others are proposed) is the net product (defined as equivalent to regional or state "national" income) of the business economy of the region. This aggregate is to be evaluated by industries for the region each year by standard national income methods. To provide a monthly index, the corresponding rate of net production for each month is to be evaluated in more tentative fashion by industry indexes based on the annual net product aggregates as benchmarks. A weighted average of the monthly industry indexes provides the final monthly business activity index originally sought. Alternative forms of the index are discussed.

The final chapter of the thesis presents a tentative index for the state of Washington computed within the proposed framework. The index is based on annual estimates of the net product of the business economy of Washington; these estimates are derived by expanding comprehensive wage and salary data for the state to the full net product level by use of national industry relationships obtained from Department of Commerce national income data. The index is presented in current dollars and in a roughly deflated form, and is compared with other business activity indicators for the state of Washington.

250 pages. \$3.13. MicA54-2905

ACCOUNTING STANDARDS

(Publication No. 10,177)

Louis Hampton Jordan, Ph.D.
Columbia University, 1954

The purpose of this paper is to examine the nature and development of accounting with a view to clarifying the area commonly referred to as accounting principles.

A study of this type is appropriate because past efforts to deal comprehensively with accounting principles have been unsuccessful and because of controversies that have arisen during the recent inflationary period.

The most significant fact dealt with is the utilitarian nature of accounting. Accounting is to be viewed as an instrument of administration and control. Its function is to supply financial information needed in the operation of an economic unit. It is dynamic in nature and to a great extent pragmatic and conventional. As specifics in the economy change, accounting must adapt itself accordingly.

The body of accounting principles includes ideas, assumptions, and rules of varying degrees of importance. Some are basic and have widespread application; others relate to specific situations, while still others are trivial. Many accepted accounting principles are in conflict with others that are also accepted.

Accounting practices are to be judged by their effectiveness in accomplishing desired ends. Different purposes call for different considerations and different accounting procedures. When financial representations are made to outsiders, management does not enjoy the same degree of freedom in employing accounting procedures as it does for internal purposes. Usefulness must be considered from the standpoint of representees who have the right to rely on representations made to them. Here a public interest is involved, and if there is a conflict in ends to be served, usefulness must be considered from the standpoint of society as a whole.

Accounting standards are those accounting principles which are capable of measuring the quality of financial representations. They are desirable characteristics of financial representations and serve as guides in choosing non-standard principles to follow for a specific purpose.

Most accounting principles in the non-standard category are procedural in character. Accounting procedures are means and methods of accomplishing accounting work. The non-standard category includes, also, certain postulates and conventions that are neither standards nor procedures.

The following accounting principles fall in the category of standards and are discussed in this paper.

1. Standard of Honesty of Representation: Financial representations should be understandable to the person to whom they are made and are to avoid being untruthful, incomplete, and misleading.
2. Standard of Objectivity: Accounting should be based on objective, verifiable evidence.
3. Standard of Comparability: Accounting data should permit comparisons which are essential for the exercise of informed judgment.
4. Standard of Stewardship: Accounting should be in terms of responsibilities and should enable one to determine how management has fulfilled its responsibilities.

In selecting accounting procedures to follow in a specific case, one should choose those that come closer to accounting standards as a whole. An

adopted procedure remains a procedure; it is to be replaced when its use does not meet accounting standards. 106 pages. \$1.33. MicA54-2906

SCANDINAVIAN AIRLINES SYSTEM: A CASE OF INTERNATIONAL COOPERATION

(Publication No. 9018)

Robert Alfred Nelson, Ph.D.
Clark University, 1954

In February 1951, Danish, Norwegian, and Swedish government and private interests entered into a consortium agreement which created Scandinavian Airlines System. Functioning as a single operating entity, the consortium SAS is jointly owned by the three national companies, Danish Airlines (DDL), Norwegian Airlines (DNL), and Swedish Airlines (ABA). The national companies, each of which is fifty per cent publicly-owned, are relegated to the status of holding companies. SAS is the first airline in the world to claim a multiple nationality.

The agreement in 1951 to pool commercial aviation resources evolved out of two more limited experiments with cooperation. In 1946, Danish Airlines (DDL), Norwegian Airlines (DNL), and Swedish Intercontinental Airline (SILA, merged into ABA in 1948) formed a consortium for intercontinental flying. The companies carried on European and African operations separately until 1948 when they fashioned a pooling arrangement for that traffic. Having by then gone a considerable way toward complete unification, and being dissatisfied with a multiple organization form, the three companies in 1951 merged their aviation activities.

Three sets of factors, augmented by the ambition of private commercial interests in the three companies, provoked the cooperation.

One. The limitations and restrictions imposed by national sovereignty over airspace force small airlines upon small nations. The *quid pro quo* negotiation of bilateral air agreements often works to the disadvantage of smaller nations. Large powers tend to contain the air traffic centers of the world. The terms of air agreements between large and small powers reflect the relative strength and needs of the parties.

Two. Small aviation establishments may be undesirable even to small nations. The economics of airline operation favor large carriers because unit costs decline with increases in the size of plane and fleet. A nation with widespread trade relationships may find desirable an airline with extensive connections throughout the world. Since airlines are instruments of commerce, nations with expanding trade may want their airlines to keep pace. Commercial aviation is closely related to national defense. In so far as planes necessary for defense are employed commercially, a reduction in cost of defense results.

Three. The political atmosphere in Scandinavia in 1950 was extremely favorable to cooperation.

Even before the establishment of the European Cooperation Administration and the Organization for European Economic Cooperation, the three countries had explored several activities in which they might cooperate, such as defense, customs, electric power, currency, labor pools, etc. The programs for cooperation in Western Europe encouraged by the United States provided additional incentive to the three countries to engage in some form of cooperation. With the exception of aviation, all attempts at cooperation foundered upon the rocks of national interest.

The decision to joint efforts in commercial aviation was not made without opposition and controversy. The frictions which appeared in the overseas cooperation of 1946 were alternately aggravated and allayed throughout the course of the SAS development. Opposition was strongest in Norway where benefits were thought to be least. Norwegians expressed concern that national defense would be weakened, that Norway's civil aviation would atrophy, that SAS would be costly and would not serve Norway's air needs, and that Norway would inevitably suffer by any cooperation with the Swedes.

Throughout the experimental period and the negotiations, good sense and faith brought realization that the benefits to be gained by cooperation promised to exceed the drawbacks. The three countries came to believe that their disadvantages of small size could be largely overcome by cooperation, that a united front would win more satisfactory air rights from other countries than individual bargaining, and that the need of the three countries for air service would be large enough to utilize an airline of economic size. Commercial aviation provided the three countries an opportunity to demonstrate their intent and desire to cooperate. 281 pages. \$3.51. MicA54-2907

THE COTTON TEXTILE INDUSTRY

(Publication No. 9783)

Irwin Mark Stelzer, Ph.D.
Cornell University, 1954

The cotton textile industry, has long been of interest to economists because it approximated the theoretical model of pure competition. Study of its structure reveals, however, that recent events have led to an increase in the level of concentration, the percent of total facilities controlled by the four largest firms having risen from 6.8 percent in 1920 to 14.2 percent in 1953. Although the industry is one in which there seems to be a relationship between plant size and operating efficiency in most branches, differences in the efficiencies of large and small firms are insufficient to explain this increased concentration. The growth of the four leading firms has been accomplished largely through merger. This merger activity, reaching its peak in the 1940-1947 period, saw both an increase in the level of concentration, and a rapid rise in the extent of vertical integration. The causes of this recent integration movement

included the desire to participate in the higher margins allowed by O.P.A. on finished goods, the war-induced shortages of gray goods and machinery, the tax structure, the chaotic market conditions which had characterized the non-integrated markets of the 1930's, and the desire for the quality and price control which vertical integration and product differentiation could bring. The wave of integrations and mergers has abated since 1947, and a new equilibrium at a higher degree of integration has been achieved. Thus the independent converter has come to specialize in the high style items on short runs and the integrated mills in the less stylized and larger lots. Although there has been little evidence of non-integrated organizations having difficulty in securing supplies or markets, the change in the industry's structure did affect the nature of its price-output behavior.

In the prewar era there was a strong tendency for cloth prices to turn down before production when demand fell, and for production to turn up before price when demand recovered. It was not uncommon for falling prices to be associated with increased output, as declining mill margins and unit profits caused mills to expand output in an attempt to maintain total profits. In more recent years, on the other hand, production has tended to lead in downturns, and to rise simultaneously with price during recoveries. Since this change is not due to any change in the nature of direct costs, it seems that the number of sellers, the entry conditions, the degree of integration, and the extent of product differentiation do have important influences on price-output behavior.

The cotton textile industry also throws some light on the manner in which a competitive industry adjusts to the problems of excess capacity and declining demand. The appearance of excess capacity in the industry in the 1920's drove profits to extremely low levels. This caused a competitive catharsis which brought with it a return of profits to normal levels.

Finally, this industry's innovation pattern tends to reveal a rate of advance well below the average for all industries — a condition which study reveals to be due to its competitive structure. Cotton textile manufacturers have rarely been possessed of the above-normal profits evidently required to finance research, and not until the recent appearance of large, integrated organizations has the industry evidenced any propensity to adopt the long-run view necessary for the growth of research consciousness.

With the exception of this relative lack of technical advance, the cotton textile industry is one in which competition would be declared workable, although cotton textile prices no longer move to equate short-run changes in demand with supply to the extent that they once did.

215 pages. \$2.69. MicA54-2908

ECONOMICS, FINANCE (INCLUDING PUBLIC FINANCE)

U. S. MONETARY AND CREDIT POLICIES BETWEEN THE END OF WORLD WAR II AND THE OUTBREAK OF THE KOREAN WAR, WITH SPECIAL EMPHASIS ON QUANTITATIVE CREDIT CONTROLS

(Publication No. 10,167)

Harry Brandt, Ph.D.
Columbia University, 1954

This study is intended to provide a thorough analysis of monetary and credit policies for the above period. Most of the discussion is devoted to quantitative credit controls. Selective instruments are touched on briefly, and some consideration is given to debt retirement.

Chapters I and II present a brief discussion of monetary policies for the period 1933 to 1945. Chapters III and IV are devoted to an examination of credit controls during the 1946-1948 boom. A similar review of the 1949 recession and early 1950 period of renewed business activity follows. The objectives and actual measures undertaken during each of these periods are treated historically against a background of economic conditions. Their rationale is heavily documented with material from publications of the monetary authorities and testimony of their officials before numerous Congressional hearings and investigations. The policy actions are then thoroughly analyzed in terms of their effect on bank reserves, money stock, interest rates, security prices, lending and investment activities of financial institutions, and ownership distribution of the debt. A critique of the broad objectives is presented in Chapter VII. Reserve proposals are discussed briefly in Chapter VIII. A final evaluation is set forth in Chapter IX.

The study reveals that the record of monetary management was unimpressive since its character was predominantly influenced by debt considerations rather than changing economic and business conditions with the possible exception of the second half of 1949. During the 1946-1948 boom, the Federal Reserve System was an engine of inflation. Some restrictive measures were adopted, but with the exception of debt retirement from surplus, their anti-expansionary effects were small. The net influence of Federal Reserve open-market policy during the entire 1949 recession appears to have been deflationary. Other actions, apart from the repayment of Federal Reserve-owned debt, tended to have the opposite effect. During the business advance of early 1950, monetary actions tended to have a slightly inflationary impact. Findings further indicate that the greatest inflationary impact of quantitative credit actions took place when inflationary conditions were most rampant (i.e., last half of 1947 and second quarter of 1950). Their most deflationary influence occurred when the decline in economic conditions was most rapid (i.e., first half of 1949).

The timing of certain credit actions is open to question, and some should never have been pursued. The most serious criticism is leveled against maintenance of low and stable interest rates (i.e., a stable Government securities market), since this limited the effectiveness of credit restraint during the inflation and, to a lesser extent, the desired monetary ease in the recession.

Arguments in favor of this policy by the Treasury and Reserve System are not impressive. The size and importance of the debt did not allow a complete lack of concern for the Government securities market, nor were large interest rate fluctuations desirable. However, a more flexible interest rate policy, such as that adopted in March, 1951, should have commenced in the spring of 1949, or preferably in early 1947. This would have helped diminish both inflationary and deflationary pressures without severe repercussions to the Treasury and financial institutions and would have obviated the Reserve Board's request to impose a secondary reserve requirement on commercial banks during the inflation.

In general, monetary policy should never be an unstabilizing element. It should contribute to economic stability by being flexible in adjusting itself predominantly to changing economic conditions without undue interference with the management of the debt.

539 pages. \$6.74. MicA54-2909

AN ECONOMIC ANALYSIS OF THE AGRICULTURAL PRODUCTION LENDING ACTIVITIES OF MINNESOTA COUNTRY BANKS

(Publication No. 10,024)

Reynold Paul Dahl, Ph.D.
University of Minnesota, 1954

Adviser: E. Fred Koller

The purpose of this thesis was to determine how satisfactorily commercial banks are supplying the production credit needs of Minnesota farmers. The inquiry into the problem is based upon loan sample data obtained from 16 Minnesota country banks. Information on lending policies and practices was obtained from 16 additional banks. Another phase of the study dealt with farm machinery credit because of its special significance. Fifty-seven banks were included in this phase of the study.

Eighty-five per cent of all loans studied were on a demand basis, or for a term of six months or less. That these terms are not long enough to cover farmers' needs is indicated by the fact that one-third of the loans involved some form of renewal. Also, by obtaining the disposition of each loan, it was found that 44 per cent were renewed at maturity. Banks devote little attention to borrower income analysis in their loaning operations. This is a major factor contributing to the present policy with respect to loan terms. Advantages would accrue to both borrower and lender if the maturity dates were geared to the time of anticipated farm income.

Certain banks had more complete files of borrower financial statements and made more effective use of them than others. Indications were that a number of banks failed to recognize the comparison value of financial statements to follow financial progress and changes in borrower net worth over time. Credit files are a great help in making loans and should be given more attention.

The most common interest rate on short-term farm loans was 7 per cent, as 41 per cent of all loans were made at this rate. Thirty-three per cent of the loans were made at 6 per cent and 17 per cent were made at 8 per cent. It was apparent that the typical country banker had a considerable degree of latitude in determining interest rate charges. Some of the observed variations in interest rates were attributable to differences in costs, particularly interest rate variations by agricultural regions. Variations within regions were indicative of imperfect competition in the farm production loan market. Intra-bank variations were accounted for in part by size of loan. Varying the interest rate by size of loan is a crude, inaccurate, means with which to recoup the costs connected with making a loan. A schedule of fees based on accurate cost accounting data to cover these costs would be more accurate and equitable.

With respect to farm machinery loans, the same sound banking principles that apply in making direct loans should also be applied in purchasing dealer contracts. If not, contracts may become a means by which over-extension of credit through split-lines may occur. The advantages of direct loans outweigh those of contracts for the typical farmer.

Fifty-five per cent of the assets of the average Minnesota rural bank consisted of cash and United States government obligations. This leads to the conclusion that banks could make longer term farm production loans without unduly hampering their liquidity. This would be particularly true if banks look to bonds for liquidity rather than return. The liquidity requirements, consequently, can be satisfied to an important degree through the investment portfolio.

An analysis showed substantial changes in the financial structure of country banks over time. It also revealed several lessons in the management of bank funds that country banks have learned through painful experiences in the past. A consideration of these lessons, deposit insurance, and the increased liquidity of banks leads to the conclusion that country banks will be a more reliable source of agricultural credit in the future.

201 pages. \$2.51. MicA54-2910

WAGE STABILIZATION POLICIES AND PROBLEMS, 1950-1953

(Publication No. 9084)

Dale Ansgar Henning, Ph.D.
University of Illinois, 1954

Wage Stabilization Policies and Problems, 1950-1953 analyzes the wage control program established to help control the economic disturbances which took place during the Korean War.

A study of the antecedents of the Korean wage controls is necessary to the understanding of the problems faced by the wage administrators in 1950-1953. Thus, this study undertakes to examine the experiences under the controls program of World War II.

The theory of economic controls is examined. The objectives of such controls are cited. Their advantages and limitations are discussed — with special emphasis on the role of wage controls.

One chapter is devoted to an analysis of the organization for economic control. The legislative and administrative bases for the wage control program are examined. The study includes a discussion of the top-level organization for economic controls, the internal organization of the National Wage Stabilization Board, and the relation of the National Wage Stabilization Board to other controlling bodies.

The evolution of the wage policy structure of 1950-1953 has been told piece-meal. This work attempts to tie together isolated incidents and to interpret the trend of developments within the Wage Board and in the public attitudes towards the wage control program. This chapter examines the relaxation of wage controls chronologically and interprets the demise of the wage control program.

There were two new, different, and basic wage policies developed in the Korean period. One was perhaps the most important wage policy promulgated — the so-called "escalator" or cost-of-living wage policy. The other was the policy of allowing wages to rise in accordance with the long-term average improvement in productivity. These public policies and their economic ramifications are examined in detail.

The final chapter is an evaluation of the 1950-1953 wage control program. A precise and exact evaluation of such a program is unfeasible because of the many economic variables affecting the stabilization efforts. However, an attempt is made to show some of the criteria for measuring the attainments made under the wage program and to apply them to the 1950-1953 experience. The study offers some conclusions as to the timing of wage controls, the liberality of the policy structure, the organization for wage control, and the determinants of the stringency of wage controls. 252 pages. \$3.15. MicA54-2911

objective of profit. These transactions have similarities, or characteristics, which enable one to classify or group them. Those transactions which affect income for the period are grouped in the profit and loss statement.

The income characteristic is useful, but other characteristics are also significant. For example one group of transactions affects the composition and amount of working capital, while other transactions affect the fixed asset investment. Collection of receivables and payment of short term obligations are illustrations of working capital transactions. Fixed asset additions, betterments, and depreciation are examples of fixed asset transactions.

The inadequacies of the balance sheet, the surplus, and the income statement in disclosing completely the nature and effect of asset transactions are somewhat apparent. The funds statement impinges on this area, however, and might be considered by some to constitute adequate disclosure.

Several deficiencies can be attributed to the funds statement. The most important of these is the lack of a clearly stated objective. Some accountants believe the statement should disclose cash transactions, while other accountants believe the statement should disclose the changes that have taken place in the non-current accounts of the balance sheet. An additional inadequacy of the funds statement is observed in the lack of development of significant relationships. At a time when financial statements have been examined by skilled analysts and many ratios developed, none have been suggested for the funds statement.

It is contended that satisfactory techniques for reporting working capital and fixed asset transactions can be developed, and methods of obtaining and presenting the required data are discussed. A statement of working capital transactions and a statement of fixed asset transactions are proposed. The statement of working capital transactions is designed to show the circulation of working capital through transactions, which constitutes one of the major areas of attention for financial management. The statement of fixed asset transactions is designed to show the expansion or contraction of productive facilities, and to reveal corporate policies as to maintenance and repairs. 163 pages. \$2.04. MicA54-2912

REPORTING ASSET TRANSACTIONS

(Publication No. 9123)

Malcolm Lionel Pye, Ph.D.
University of Illinois, 1954

Accountancy reveals corporate activities to interested groups by means of financial statements. It is believed that generally accepted practices for the organization and reporting of accounting data are deficient and that additional reports can be developed that will extend the usefulness of accountancy.

From an accounting standpoint, corporate activities result in transactions which have an ultimate

BRITISH BACKGROUNDS OF AMERICAN ACCOUNTANCY

(Publication No. 9169)

Vernon Kenneth Zimmerman, Ph.D.
University of Illinois, 1954

British influences upon American society are evidenced in many ways, such as language, units of measure, and fashions. It seems only logical to suspect that there has also been a British influence upon the specific area of American accountancy. The goal of this study is the determination and evaluation of the British backgrounds of American accountancy.

An approach to such an historical study will quite naturally call for the division of the study into meaningful chronological periods. An appraisal of British and American economic history and of British and American accounting history seems to allow the following chronological divisions: (1) the development of British accountancy to 1870, (2) the development of British and American accountancy from 1870 to 1900, and (3) the development of British and American accountancy from 1900 to 1919.

A study of the early backgrounds of British accountancy before 1870 seems necessary to indicate the British economic climate in general and the resultant British accounting development in particular of those important early years. The year 1870 is selected as a stopping point because it was approximately at this time that a British accounting profession was recognized. Thus a new era was about to begin.

The years 1870 to 1900 form the "critical generation" of study. These years witnessed an amazing period of world expansion particularly in Great Britain and the United States. British economic influence reached its peak during this era and it is particularly rewarding to examine both British and American accounting developments during these years to determine possible British backgrounds of American accountancy.

The study continues for the years 1900 to 1919. These years again witnessed some climatic shifts of national power. The First World War marked the assumption of international economic leadership by the United States which had formerly been held by Great Britain. The close of the war era, 1919, reveals that the British influence upon American accounting paralleled the decline of the British economic influence upon the United States.

The British were aware of the usefulness of accounting in the days of the manors and guilds. However, it was the more vigorous commercial economy of the Mercantile Era and later the Industrial Revolution that brought the British accountancy profession to flower in the nineteenth century.

The concern of British investors for their American investments caused a migration of British accountants to the United States in the 1880s. The profession which had so recently become an accepted part of the English commercial scene was transferred with its attendant practices and procedures to the American business scene. American accounting underwent its first stage of development as a direct result of the stimulus and example furnished by the transplanted British accountants.

The particular needs of a national economy predicate the resulting course of accounting development. The financial problems and needs of the American economy after 1900 were reflected in the extreme creditorship financing of American concerns, the large accumulations of capital, and the acceptance of mass-production practices of American businesses since 1900. The economic eclipse of Great Britain by the United States during the years 1900-1919 was accompanied by developments of American accountancy independent of contemporary British

developments and especially adapted to the needs of the expanding American economy.

British backgrounds of American accountancy are visible to the modern day. These British backgrounds arose during the years 1870-1900 to fulfill a current need. But the years 1900-1919 saw the British influence upon American accounting developments gradually disappear. 241 pages. \$3.01. MicA54-2913

ECONOMICS, HISTORY

A STUDY OF POPULATION AND CAPITAL MOVEMENTS INVOLVING THE SOUTH

(Publication No. 9035)

John Wood Beall, Ph.D.
University of Illinois, 1954

This study has two objectives: (1) to test the hypothesis stemming from traditional economic theory that the price system would tend to move labor out of and capital into a low-income area such as the South, and (2) to explore the implications for the national economy of including within it a labor-reserve area such as the South.

Following Howard W. Odum, the South is defined to include Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

Using net migration estimates of the Bureau of the Census and the University of Pennsylvania Studies of Population Redistribution and Economic Growth, net migration rates for each state and the region were calculated for various periods from 1910 to 1950. The region lost population in all periods. Florida was the only consistent receiver. The rate of out-movement fell during the 1930's but recovered rapidly in the 1940's. Those Southern states with the lowest per capita incomes tended to have highest migration rates. Negro migration rates have been higher than white rates, and fell less than white rates during the depression. More migrants from the South move from urban residences than would be expected on the basis of the regional rural-urban distribution of population. The concurrent movement of population out of Southern agriculture supports the hypothesis that there is a two-stage movement from the region, from Southern farm to Southern city to non-Southern city.

There are no direct data on capital movements. Therefore, the hypothesis of a net in-flow of capital must be examined indirectly. Census of Manufactures and Department of Commerce construction data indicate Southern growth rates in new construction, value added by manufacturing, number of production workers, manufacturers' expenditure for new plant and equipment, and number of business establishments which are above the national average. Southern per capita incomes are enough below the national

average that a regional savings rate high enough to support this growth is unlikely.

Relatively low Southern per capita incomes and the willingness of Southerners to move out of the region when jobs are available are held to be evidence of a large volume of disguised unemployment. The level and elasticities of labor supply in all non-Southern labor markets are higher than if this pool of under-employed did not exist. The output limits of the economy are increased. Expansions in aggregate demand will not meet inelastic labor supplies until labor has shifted from lower to higher productivity employment.

The regional concentration of this labor reserve means that this process of shifting necessitates a geographic move. More time to communicate labor market information will be required than in the case of local markets. Thus, this potential output limit will be greater over longer periods of time. Therefore, a case can be made for public policy which would slow down expansions in aggregate demand as full employment in the statistical sense is approached. A slower rate of expansion would permit more shifting from low to high productivity employment and a greater expansion in output. Such a policy of inhibition may, of course, produce accelerator effects which would turn the previous expansion into contraction. But, if this could be avoided, expansion could be greater than otherwise.

The evidence of Southern experience is consistent with the hypothesis that the price system when permitted to operate would move capital in, and labor out of the region. The evidence also indicates that a break-down of the price system, as during the depression, produces much less factor mobility. Negro movement from the region is less price-directed than is white movement.

194 pages. \$2.43. MicA54-2914

ECONOMIC READJUSTMENT OF AN OLD COTTON STATE: SOUTH CAROLINA, 1820-1860

(Publication No. 10,185)

Alfred Glaze Smith, Jr., Ph.D.
Columbia University, 1954

The cotton plantation economy first developed in South Carolina after 1790. In the years that followed Upland or short staple cotton spread throughout the state. Riding a wave of demand for cotton that expanded faster than its supply South Carolina enjoyed a period of unparalleled prosperity.

The bonanza ended about 1820. Opening of areas west of the state made available fresh lands better suited for cotton production. Total output of the staple increased rapidly, the price fell, and South Carolina found itself at a competitive disadvantage.

Readjustment of the economy was therefore necessary. In this South Carolina did not have the advantage that lay with farmers in the New England and Middle Atlantic states. There the development of

manufacturing and the growth of urban areas made possible a large scale shift to a market oriented type of agriculture.

South Carolinians were therefore faced with four choices in their readjustment attempts. They could move out. They could shift to crops which were non-competitive with the newer areas. They could reorient the economy and shift to nonagricultural activity. They could reorganize the economy and improve its efficiency.

Move out they did. By 1860 forty percent of those born in South Carolina and still living resided in other states. This represented the most important phase of readjustment.

Attempts to shift to noncompetitive crops ended in total failure. While rice and Sea-Island cotton were largely noncompetitive, and South Carolina had a virtual monopoly of them, the size of the area within the state where they could be grown was limited. But the fundamental difficulty was that while the state was at a competitive disadvantage in the production of Upland cotton, its disadvantage in the production of different crops was still greater. To state it positively, cotton remained the most profitable cash crop that could be grown.

For the same reason attempts to shift to manufacturing met with a similar lack of success. However it must be said that probably not all was done that might have been done, if subsequent developments furnish any guide. Lack of background and experience, coupled with social rigidities, must share the blame.

This leaves, after emigration, the reorganization and improvement of the economy as the principle phase of readjustment. Since agriculture was the most important part of the economy it follows that agricultural improvement was of paramount interest. The results were mixed. Lack of technical knowledge and necessary materials, and the fact that it was often considered easier to move to fresh lands than to undertake improvements, served as inhibiting factors. At the same time the desire to effect improvement as an alternative to migration, operated to stimulate activity.

Coupled with agricultural improvement South Carolina undertook a program of internal improvements, involving first waterways and later railways, designed to facilitate commerce and reduce production costs. This program, it was hoped, would improve the efficiency and competitive standing of the whole economy.

Finally the credit situation is examined. The banking system provided adequate credit for commerce, but the predilection of the state for a sound and redeemable currency, coupled with the desire to keep down competition for existing banks and the use of part of the available facilities to finance activity in other areas created a shortage of credit. This shortage in turn hindered the development and readjustment of the economy.

In conclusion it may be said that the readjustment of the state's economy to changed conditions after 1820 was only partially successful. Much that was helpful was done. Much more might have been done.

469 pages. \$5.86. MicA54-2915

MINNEAPOLIS-MOLINE: A HISTORY OF ITS FORMATION AND OPERATIONS

(Publication No. 9625)

Norman Francis Thomas, Ph.D.
University of Minnesota, 1954

The Minneapolis-Moline Company is the result of a merger of Moline Implement Company, Minneapolis Threshing Machine Company and Minneapolis Steel and Machinery which took place in 1929.

Moline Plow Company was the oldest of the three, having grown out of a partnership of Candee, Swan and Co. and was incorporated in 1870 as MPC. Between 1870 and 1890 the branch house system was developed for distributing the product which had been improved by major innovations in the period. The Stephens family secured control in the 1890's and inaugurated a period of expansion in which MPC became a "full line" manufacturer. Prior to entering the tractor and automobile business in 1914-15 public financing was secured, thus ending the period when the plowing back of earnings into the company was required in order to finance buyers and to expand. In 1918 John Willys bought controlling interest and sent in a professional management team which planned to expand the line further and begin selling on a cash basis. Following World War I, the depression bore heavily upon the company, forced a reorganization and partial liquidation in 1923-24, then a second one in 1925, which resulted in the formation of Moline Implement Co. After the depression lifted in 1925 Moline Implement made profits, sold for cash, and was seeking a buyer when the merger gave an opportunity to strengthen its forces.

Minneapolis Threshing Machine Co. was moved from Fond du Lac to Hopkins, Minn., in 1887. By 1891 it began producing steam engines to complement its line of threshers, narrowly avoided insolvency in the depression of 1893, and upon recovery saw founder John McDonald replaced as president by F. E. Kenaston. Industry wide merger attempts failed but MTM expanded its market by buying into a Canadian manufacturing firm in lieu of establishing branches in Canada. By 1913 MTM had entered the tractor business and twelve years later abandoned steam engine production. The thresher was constantly improved, met with popular favor, and in the 1920's fathered the combine. Under President N. A. Wiff it weathered the depression of the 1920's because of its large reserves, and sought a merger both to strengthen its marketing position and to renovate the factory.

Minneapolis Steel and Machinery which was founded in 1902 by the Gillette family, J. L. Record and others, first marketed fabricated steel products. After fulfilling several contracts to manufacture tractors it entered that field on its own account before World War I. During the war, 90 per cent of its capacity was used in making war materials, but when this demand vanished it turned to steel threshers and then to a well designed tractor. The depression broke upon the over-expanded company, it barely missed liquidation, and as the depression

lifted W. C. Mac Farlane was sent to rejuvenate the ailing firm. After the debts were paid the company was refinanced, and the vigorous management took the lead in promoting the merger with Moline Implement Co. and Minneapolis Threshing Machine Company. 322 pages. \$4.03. MicA54-2916

ECONOMICS, THEORY

AN INQUIRY INTO THE LOGICAL AND EMPIRICAL FOUNDATIONS OF THE SUBJECTIVE THEORY OF VALUE

(Publication No. 10,183)

Stephen William Rousseas, Ph.D.
Columbia University, 1954

This study begins with the historical development of the theory of subjective value from the marginalist to the Paretian revolt and shows that both resulted in improved insights into the complex relationships of economic life. The marginalist school supplanted the labor theory of value by showing that the complex phenomena of a modern exchange economy could be explained in the simple terms of subjective human needs. But insofar as it based its theories on a quantitative concept of utility, it was in turn replaced by the ordinalist school of Pareto and Hicks.

In the process of freeing itself from the utilitarian assumptions of its predecessor, the indifference curve approach succeeded the marginalist school by providing simpler and more coherent explanations of the same phenomena. Though few today would deny the superiority of indifference curve analysis over the quantitative marginalist approach, many would agree that both are equally vacuous of empirical content. It is precisely on this point that this entire study pivots.

It is our contention that the Hicksian theory of value contains much empirical content; that the most cogent argument which can be made in favor of it is that it restates the theory of subjective value in terms of objective and measurable magnitudes. It is argued, further, that though we cannot have knowledge of preference fields in their whole extent, we can on the basis of partial information test empirically some of the basic principles of the theory of value, and that with only partial information of a group of individual preference fields we can in fact derive a composite picture of an indifference map.

In the formal part of this study, we rule out all extra-logical data and rely solely on the money expenditures which are empirically observable in given price-income situations. On the basis of these empirically observable money expenditures and in the absence of any detailed knowledge of a consumer's preference field, we then determine, through the use of formal logic, the welfare inferences which can be drawn from the relations between these money

expenditures. The welfare inferences thus determined constitute the conditional welfare propositions of the theory of value.

The remainder of the study deals with the empirical content of the Hicksian theory of value. It inquires into the experiments which can be designed, on the basis of the conditional welfare propositions, to test the convexity and consistency assumptions of the theory. It concerns itself specifically with (i) the shapes and slopes of indifference curves, (ii) the a priori and intuitive arguments that have been made in their behalf, (iii) their relation to the principle of diminishing marginal utility, and (iv) the types of critical experiments which can be devised to check their empirical validity.

Our overall conclusion is that the Hicksian theory of value is capable of experimental verification at

least with respect to its most crucial assumptions of consistency and convexity, and with respect to composite indifference maps based on the partial information of a homogeneous group of individual preference fields. The experiments described, though resulting in a complex multi-stepped experiment when combined into one comprehensive test, avoid the fatigue and nervous breakdown obstacles which preclude our finding the topography of any individual indifference map with any degree of completeness.

Briefly, this study is concerned with the "outward phenomena" of consumer behavior which make it possible to infer and to test the psychic phenomena by which they are apparently regulated, and argues that the specific situations under which we can test the basic premises of the subjective theory of value are within our experimental control.

219 pages. \$2.74. MicA54-2917

EDUCATION

EDUCATION, GENERAL

A CRITICAL ANALYSIS OF THE FUNCTION OF THE BOARD OF TRUSTEES IN THE ADMINISTRATION OF THE COUNTY SCHOOL SYSTEMS IN FLORIDA

(Publication No. 9539)

Bartley Frank Brown, Ed. D.
University of Florida, 1954

The purpose of this study was to investigate the role of the school trustees in the administration of Florida's schools.

The data gathered demonstrates that much confusion exists, not only among lay people and educators, but among trustees holding office as to the duties of the office. This was documented by publicized conflicts between trustees and boards of public instruction and the incessant stream of court cases originating over disagreement as to the authority of the trustees. Twenty-two cases centering around operations of the trustees have reached the Supreme Court. The Attorney General has handed down eighteen decisions within the last four years.

The evidence indicates that the board of trustees is an archaic office held over from the nineteenth century by a constitutional provision. The conclusion was reached that Section X, Article XII of the Florida State Constitution should be amended to abolish the board of trustees, and that all powers now residing in this office should be transferred to the board of public instruction. 166 pages. \$2.08. MicA54-2918

THE CONCEPTS OF DEMOCRACY AMONG ADOLESCENTS

(Publication No. 9638)

Grace Siu-Ying Chen, Ph. D.
University of Virginia, 1954

The purpose of this study was to find the most prevalent and the least prevalent concepts of democracy, to discover similarities and differences of opinion about democracy, and to discern indications of growth in the understanding of democracy among sixth graders, ninth graders, and high school seniors. Pupils from four cities and three rural communities participated.

A Master List of the concepts of democracy was derived from a review of literature which covered general books on democracy, textbooks, lectures, theses, periodicals, government publications, and reports on group projects. Eighty concepts were listed

under the political, economic, social, and moral aspects which embody the following eleven areas of the Master List:

- Government and the people
- Civil rights
- Freedoms
- Justice
- Economic security
- Equality
- Respect for the individual
- Privileges and responsibilities
- Majority rule and minority rights
- The appeal to reason
- Relationship with fellow men

A step by step method in obtaining a more complete picture of the adolescents' knowledge of democracy was provided in the three forms constructed. First, the pupils were asked to write an essay on "What Does Democracy Mean To Me?" and the concepts mentioned were counted according to the Master List. Then, a list of everyday problems, designed to suggest the application of democratic concepts but not stated as such, was presented to the classes for discussion. The answers given were recorded on tape and identified by the Master List. Finally, the pupils were asked to think in terms of a democracy and express their opinion on the concepts stated in a questionnaire.

The results show that pupils increase their understanding of democracy as they progress through school both quantitatively and qualitatively. Pupils from the higher grades were better than those from the lower grades. The city children averaged better than the rural children. The growth from the sixth grade to the ninth grade was greater than that from the ninth grade to the senior year. The higher grades agreed more with the recognized authorities thus were considered more mature. Older children also showed more appreciation for democracy than the younger children. Some concepts were learned earlier than others. For example, majority rule was learned before minority rights. Indications of influence of formal instruction were found on concepts like "Private enterprise" and "Separation of religion and state." The former was recognized by significantly more of the ninth graders than the sixth graders; the latter was recognized by significantly more of the seniors than the ninth graders. Some answers also reflected the pupils other life experiences in and out of school. Sometimes, the younger children give the same answers in the discussion as the older ones but for different reasons.

Pupils implied more concepts in the discussion than they mentioned in the essays. They recognized even more in the questionnaire. The difference between the grades was greatest in the essays, less in the discussion, and least in the questionnaire. The sixth graders were more responsive and expressive

than others in the discussion. The seniors were most inhibited in expressing themselves in the discussion. The higher grades, especially the seniors, were more meticulous in interpreting the meaning of words and in qualifying the statements in the questionnaire. 565 pages. \$7.07. MicA54-2919

AN INSTRUMENT FOR MEASURING READINESS FOR CURRICULUM CHANGE

(Publication No. 9544)

James Kelman Duncan, Ed. D.
University of Florida, 1954

The purpose of this study was to devise a test of readiness for curriculum change which could be used with teacher groups. It was intended that the test provide a measure of where teachers stood with regard to curriculum change.

The procedure of the study was as follows:

1. The literature on curriculum and curriculum change was surveyed.
2. The literature was searched for the factors which contributed to success or failure in curriculum change.
3. People associated with the curriculum were interviewed.
4. The evidence gathered from the literature and interviews was used to construct items.
5. Two preliminary test forms, A and B, were constructed.
6. The preliminary test forms were administered to representative groups of teachers.
7. The items on forms A and B which were most discriminating were selected for a form C.
8. Form C was administered to seven teacher groups.
9. Twenty-four items were selected from form C for a form named CIM.
10. Validity tests were made on form CIM by comparing teacher group mean scores with curriculum workers' judgments of their activity or inactivity in curriculum change.
11. Conclusions were drawn and the study was reported.

This study resulted in a valid and reliable form CIM. The scores on CIM agreed in all cases with curriculum workers' judgments of the readiness of the groups concerned. The evidence indicated that CIM was a valid measure of readiness for curriculum change and could be used as a measure of the ease with which teacher groups would engage in curriculum development.

Specific recommendations were made concerning the administration, the interpretation of the group mean scores on CIM and also for further research in the area of readiness for curriculum change.

135 pages. \$1.68. MicA54-2920

A CRITICAL EVALUATION OF STANDARDS FOR PUNCTUATION FOUND IN SELECTED HIGH SCHOOL LANGUAGE TEXTBOOKS IN RELATION TO CURRENT PRACTICES IN PUNCTUATION

(Publication No. 9090)

William Atwell Jenkins, Ph. D.
University of Illinois, 1954

The study had the purpose of determining whether current secondary language textbooks reflect current punctuation usage in the rules which they present to students. On the basis of an 82.6% agreement of the items listed in the 27 current texts evaluated by the criterion used in the study, it was concluded that they do adequately reflect current punctuation usage.

The criterion used in the study was provided by a 94-item questionnaire, consisting of 47 punctuation, capitalization, and miscellaneous usages which were judged as questionable. The questionnaire was mailed to 480 judges, who were representative newspaper and magazine editors, businessmen, book publishers, high school English teachers, and linguists. Sixty per cent of the judges returned the completed questionnaire. The tabulated results were evaluated by the Chi-square test of statistical significance and were analyzed verbally.

The verbal analysis took cognizance of conclusions based on a critical review of: (1) the nature and development of punctuation and past studies of punctuation; (2) comments made by the judges in their replies and positions and opinions found in current materials on punctuation; (3) a comparison of the five other groups of judges, who indicated forms that they personally use, with the linguists, who indicated forms that they considered standard usage.

Of the 47 usages studied, in only 7 did the textbooks disagree with current usage. Only one of these seven usages, the writing of numerals or words for numbers, presented an instance of major disagreement. The judges preferred that numbers from one to ten be spelled out unless doing so would violate readability (as in tabular matter) or consistency. The textbooks presented six different forms for this usage.

Other findings were that textbooks vary widely in their treatment of punctuation and capitalization with regard to emphasis, quantity, approach, arrangement, content, and dogmatism. The range was found to be from complete omission to a several-page section; from rules and no examples to examples only; from rules which are all stated negatively to some which take no position at all. These findings led to the conclusion that while punctuation in current textbooks does adequately reflect current punctuation usage, it does not reflect the best of current educational theory and practice with regard to sequence, scope, consistency, and emphasis because it is inadequately treated.

273 pages. \$3.41. MicA54-2921

OCCUPATIONAL EXPERIENCE AND SUCCESS OF DAY-TRADE VERSUS GENERAL HIGH SCHOOL GRADUATES

(Publication No. 9185)

Oscar Edwin Kjos, Ed. D.
University of Missouri, 1954

Major Adviser: H. H. London

Purpose of Study: The major purpose of the study was to compare the occupational experiences and success of a group of day-trade school graduates of Greater Kansas City with those of a group of general high school graduates of that area, to see if there were any appreciable differences that could be attributed to their educational backgrounds. A secondary purpose was to obtain and analyze the opinions of the two groups and their employers as to the nature and effectiveness of the training received.

Sources of Data: Data for the study were collected from school records and from information forms, which were mailed to the graduates of four high schools in the Kansas City area and to the employers of the graduates who were working in trade and industrial occupations in that area. The study included 263 general high school graduates who had taken at least two years of elective industrial arts and 136 day-trade graduates. The employers of 69 general and 50 day-trade graduates were also included. The study was limited to boys who graduated from white high schools in the area during the years of 1945 through 1952.

Summary: Larger percentages of the general high school graduates obtained their first employment, were employed in, and preferred employment in the professional and the clerical and sales occupational fields. Larger percentages of the day-trade graduates obtained their initial employment, were employed in, and preferred employment in the skilled and the semiskilled occupational fields. The majority of both groups of graduates entered the labor market through clerical and sales and the semiskilled jobs. Both groups of graduates tended to participate to the same extent in the service, agricultural, unskilled and military fields. Less than 3 per cent of either group ever worked in service or agricultural occupations. While approximately 15 per cent of both groups obtained their initial employment in unskilled jobs, after two years only 3 per cent remained in these jobs. The trend in employment of the day-trade graduates was toward skilled occupations, whereas the trend in employment of the general high school graduates was away from skilled jobs toward technical and managerial jobs.

The majority of both groups of graduates obtained their first employment through the help of a friend or relative or through their own efforts. The two groups changed jobs approximately the same number of times and for much the same reasons.

Larger percentages of the day-trade graduates made practical use of the industrial training they received in school; however, only approximately 30 per cent had worked, at any specified time, in jobs similar to the industrial courses they had taken.

Larger percentages of the day-trade graduates obtained employment in trade or industrial occupations; however, they were only slightly more successful in these jobs than the general high school graduates. From the point of view of employers, the day-trade graduates were slightly better employees as measured by the interest shown in their work, cooperation, job performance, and willingness to assume responsibility; however, the general high school graduates excelled on leadership ability.

The day-trade graduates, who were employed in trade and industrial jobs, started work at a higher weekly wage. After four years the two groups earned approximately the same average wages and increased at similar rates.

Generally, the employers of the day-trade graduates were of the opinion that the training provided by the schools should be broad in nature and applicable to a family of related occupations. Significantly larger percentages of the general high school graduates stated that their shop training was of no specific advantage to them.

178 pages. \$2.23. MicA54-2922

RELATION OF UNITS TAKEN AND MARKS EARNED IN HIGH SCHOOL SUBJECTS TO ACHIEVEMENT IN THE ENGINEERING COLLEGE

(Publication No. 9187)

Floyd Earl Krubeck, Ed. D.
University of Missouri, 1954

Major Adviser: H. H. London

Purpose of Study: The purposes of this investigation were (1) to ascertain the relationship of units taken and marks earned in high school English, mathematics, science, and industrial arts to achievement in the Engineering College, and (2) to ascertain the extent to which marks earned in each of these four high school subjects contributed to this achievement.

Sources of Data: Data for the study were secured entirely from the records in the office of the Director of Admissions, the Engineering Dean's office, the Department of Educational Psychology, and the Guidance Service of the University of Missouri. These data were recorded on individual record sheets, then punched on cards by International Business Machines and verified. The majority of the tabulations and calculations were computed on these machines.

Eleven-hundred-and-three students graduated

from the College of Engineering of the University of Missouri during the period with which this study was concerned; namely, February, 1949, to June, 1953. Of this number only 429, or 38.9 per cent, were involved in the study. The study was limited to those students who had graduated from Missouri high schools and had received all of their college training at the University of Missouri and were graduated between February, 1949, and June, 1953.

Summary: The engineering graduates involved in the study came from high schools with graduating classes averaging 123.5 in size. They ranked in the upper one-fourth of their high school graduating classes and had a mean measured mental ability of 16.5 percentile points above that considered average for college freshmen. The engineering graduates, on the average, had taken as many or more units of English, mathematics, and science as were required for admission to the College of Engineering of the University of Missouri.

The coefficients of correlation between the number of units taken in high school English, mathematics, science, and industrial arts and achievement in the College of Engineering are all quite low, indicating that there is little if any relationship between these two measures.

The coefficients of correlation between marks earned in high school English, mathematics, science, and industrial arts and achievement in the College of Engineering are of sufficient magnitude to indicate that a significant relationship does exist between these measures.

The coefficients of correlation between marks earned in high school English, science, and industrial arts and achievement in the College of Engineering are highly dependent upon marks earned in mathematics. This is quite obvious when marks earned in mathematics are held constant. The coefficients of correlation between marks earned in high school science and industrial arts and achievement in the College of Engineering are even more dependent upon marks earned in high school English and mathematics. The coefficients of correlation calculated between marks earned in the respective high school subjects and achievement in the College of Engineering, when three of the four variables are held constant, reveal that mathematics has the highest correlation with engineering achievement.

A multiple coefficient of .40 between engineering achievement and combined marks earned in high school English, mathematics, science, and industrial arts indicates that the reliability of the predicted honor point ratio in the College of Engineering would be only slightly more reliable than on the basis of prediction from marks earned in mathematics alone.

Marks earned in the four high school subjects account for approximately 16.0 per cent of the honor point ratio of the engineering graduates at the University of Missouri. Mathematics was the

variable contributing most to the honor point ratio of the engineering graduates, it being 7.66 per cent, English 5.35 per cent, industrial arts 2.48 per cent, and science 0.39 per cent.

129 pages. \$1.61. MicA54-2923

COMPARATIVE METHOD OF TEACHING PERSIAN AS THE MOTHER TONGUE AND AS A FOREIGN LANGUAGE, WITH SPECIAL REFERENCE TO THE WORK OF BEGINNERS

(Publication No. 10,154)

Salim Neysari, Ph. D.
Indiana University, 1954

The script is the medium of reading and writing. The evaluation of a script is an attempt to find out how well a writing system fits the language for which it is used.

Persian, which belongs to the Indo-European family of languages, is descended from the ancient language spoken by the Aryans. The language during its long history has employed six different types of writing. The present writing (the Arabic alphabet) was introduced for recording Persian under the influence of Islam. The Arabic alphabet, a Semitic writing, is characterized by the omission of vowel characters and certain other difficulties. The evaluation of the Arabic alphabet in relation to Persian proves the unsuitability of this writing to the needs and patterns of the language.

These defects of the writing system, in addition to other factors, are partially responsible for the unsatisfactory method of teaching reading and writing to beginners now used in Iran. Among these factors are the fact that most teachers lack the necessary background and information in the methods of teaching, that there is little guidance in techniques or access to research studies, and lastly that most textbooks are unsuitable, and teaching aids and materials are scarce.

The term "beginners" in this study applies to a) first grade children, b) illiterate adults, c) bilingual members of minority groups (children as well as adults), d) foreigners studying Persian.

Persian as a classical language with a high prestige and a literature of more than one thousand years has had a far-reaching influence abroad, lasting many centuries.

Helping all these four types of beginners to greater success in learning Persian is sought in two fundamental ways: the reform of writing, and the improvement of methods of teaching.

After some discussion of spelling reforms and consideration of trends, a new alphabet is proposed for Persian which is based on the principles of the International Phonetic Association. This alphabet, with only 29 letters, fits perfectly and accurately the phonemic system of Persian.

The latest research findings with regard to methods of teaching first grade children are discussed in the light of three main points: a) The teacher's

relation and understanding of the children's general characteristics, personal needs and individual differences. b) The nature of a modern curriculum which provides opportunities to apply a successful method of teaching. c) The observation and evaluation of results.

The results of the latest studies on methods of teaching language arts to adults, bilinguals, and foreigners, is gathered, and the differential points in each case are clarified.

In conclusion, some suggestions are made for the application of those improved methods and ideas, in the form of practical steps leading to the desired goals and objectives. These suggestions are brought under four main headings: 1) The improvement of the methods of teaching language arts to beginners. 2) Adult education. 3) Writing reform. 4) The extension of Persian abroad.

145 pages. \$1.81. MicA54-2924

THE LEADERSHIP FUNCTION OF THE
STATE DEPARTMENT OF EDUCATION IN
THE IMPROVEMENT OF NURSERY
SCHOOL AND KINDERGARTEN
OPPORTUNITIES IN VIRGINIA

(Publication No. 10,022)

Davis Young Paschall, Ed. D.
University of Virginia, 1954

The Problem

The purpose of this study was to clarify the leadership function of the State Department of Education in the improvement of nursery schools and kindergartens in Virginia.

Method of Procedure and Sources of Data

1. Reports of The National Council of Chief State School Officers, research studies of the United States Office of Education, bulletins and documents of the State Board of Education in Virginia, official addresses and written statements of the State Superintendent of Public Instruction and the Governor of Virginia, and the viewpoints of authorities in the field of education, were examined in terms of their description of the purposes of the State Department of Education.

2. Data from Virginia and sixteen other states, and the findings of authorities in the field of early childhood education were reviewed. This information was organized to indicate comparable analyses in the areas of legislation, plant and equipment, program and staff.

3. The findings of a 1953 survey of 150 private nursery schools and kindergartens in Virginia were reported.

4. The investigator contacted nursery school and kindergarten teachers enrolled in early childhood education classes at the University of Virginia and at Richmond Professional Institute, three parent groups, and Dr. Hazel Gabbard, Specialist in Extended School Services of the United States Office of Education, for

reactions to the material describing nursery school and kindergarten programs.

Summary of Major Findings

The findings of this study were:

The leadership function of the State Department of Education

1. The primary purpose of the State Department of Education was found to be that of rendering leadership service in the solution of recognized problems.

2. In achieving this service function, the concept of leadership that holds the greatest promise for maximum progress was defined as democratic leadership.

3. When applied to the service function of the State Department of Education, this concept of democratic leadership was found to require conscious avoidance of thinking and acting in terms of predetermined outcomes, prestige of position, dictating assignments, and forcing people to accept products not of their own making or participation.

Major problems encountered in the improvement of nursery school and kindergarten opportunities

1. In terms of State Department of Education relationships to a segment of the educational system for which no State funds are provided, the question of the nature and extent of leadership responsibility that can and should be exercised is one involving basic consideration.

2. Under our system of education the State of Virginia guarantees all children and youth an opportunity for free elementary and secondary schools while, at the same time, it protects the right of every parent to have his child attend a nonpublic school. Does this guarantee place upon the State the responsibility of safeguarding certain minimum educational opportunities for all children which would require general supervision of public and nonpublic schools?

3. Should the State Board of Education establish standards that are essentially regulatory in nature or those that are designed to encourage self-improvement on an advisory basis?

Plans for improvement of preschool opportunities - a direction for State Department of Education leadership

1. As an action step in the practice of democratic leadership, the State Superintendent of Public Instruction appointed an Advisory Committee on Nursery Schools and Kindergartens in Virginia. Through this potential of joint endeavor, a more extensive representation of those on State, regional, and local levels, who are concerned with problems in the preschool area can be envisioned.

2. Leadership action initiated through this study resulted in the enactment of permissive legislation by the General Assembly in 1954 that now enables the State Board of Education to provide for standards for nursery schools and kindergartens.

3. A guide to self-improvement of nursery schools and kindergartens has been developed as an integral part of this study. The recognized necessity for

future revision of this material provides a challenging opportunity for the operation of the leadership function of the State Department of Education.
184 pages. \$2.30. MicA54-2925

**TROUBLE SHOOTING ELECTRONIC
EQUIPMENT: AN EMPIRICAL APPROACH
TO THE IDENTIFICATION OF CERTAIN
REQUIREMENTS OF A MAINTENANCE
OCCUPATION**

(Publication No. 9132)

Joseph Lee Saupe, Ed. D.
University of Illinois, 1954

An empirical study of aspects of proficiency in trouble shooting electronic equipment was made in conjunction with a larger research project supported by the United States Air Force. The purposes of the study were (a) to develop a psychological model by which to view trouble-shooting behavior, (b) to test certain hypotheses taken from this model and relating to aspects of the trouble-shooting process, and (c) to illustrate an empirical approach to the identification of important objectives of training programs for maintenance mechanics.

Trouble shooting, the process of locating sources of trouble in malfunctioning equipment, was taken to be a type of diagnostic problem-solving task. A prototype or model trouble-shooting process, which viewed the process as one of logical elimination, was developed on the basis of a review of selected research and writings on the psychology of problem solving and thinking. Nine hypotheses concerning factors in proficiency were formulated on the basis of this model. The first hypothesis concerned the relation between knowledge of basic electronics facts and principles and success in trouble shooting. The next several hypotheses involved the contributions or detractors which several specified components of the problem-solving process make to success in trouble shooting. The final hypothesis related to the consistency and relative efficacies of different over-all methods of attack to trouble-shooting problems.

Data for the study were taken from the administration of a trouble-shooting performance test and a written test of basic electronics knowledge to a sample of forty radio maintenance mechanics. The performance test utilized a specially constructed, superheterodyne, radio receiver. For each subject, eight test troubles were inserted into this receiver. Complete behavioral records of trouble-shooting procedures used by subjects in attempting to locate each of the troubles were made by trained observers. The written test covered facts and principles of general fundamentals of electronics and characteristics of the circuitry and principles of operation of the special radio receiver.

The scores on the written test and the behavioral records of trouble-shooting processes from the performance test were subjected to statistical analysis for testing the several specific hypotheses. It was

concluded that basic knowledge, as measured by the written test, is a necessary, though not sufficient, condition for success in trouble shooting. Significant individual differences were shown to exist with respect to the occurrence of several of the specified behavioral components of the problem-solving process. Furthermore, several of these components were shown to be significant contributors to or detractors from success in solving individual trouble-shooting problems, and several were shown to be related in the predicted manner to the total number of performance test problems passed. It was also concluded that mechanics can be differentiated on the basis of characteristic over-all methods of attack to trouble-shooting problems, and that the different methods possess varying degrees of efficacy for solving trouble-shooting problems. As hypothesized, the method called logical elimination was most efficacious.

The results of the experimental part of the study were discussed as illustrating an empirical approach to the identification of strategic aspects of proficiency in trouble shooting. Several implied objectives for training programs were suggested and discussed with respect to their implementation. Other implications related to further research on problems in the selection and proficiency appraisal of maintenance personnel.
179 pages. \$2.24. MicA54-2926

**SURVIVAL EDUCATION: A SURVEY OF
TRENDS IN SURVIVAL EDUCATION IN
CERTAIN PUBLIC SCHOOLS AND TEACHER
TRAINING INSTITUTIONS AND A DETAILED
STUDY OF THE ELEMENTS OF SURVIVAL
EDUCATION FOUND IN THE PROGRAMS OF
THE BOY SCOUTS AND GIRL SCOUTS
OF AMERICA**

(Publication No. 9778)

Harald Schraer, Ph. D.
Cornell University, 1954

Chairman: Eva L. Gordon

The status of survival education, that education which develops the skills, knowledge and attitudes necessary to cope successfully with hazardous situations of whatever kind and wherever they may occur, was investigated in the public schools, the teacher-training institutions and in the programs of the Boy Scouts and Girl Scouts of America.

The subject of survival education was arbitrarily divided into five topics and thirty-one elements or items as shown below:

<u>Safety</u>	<u>Travel</u>	<u>Camping</u>
Traffic	Automobile	Orientation
Industrial	Airplane	Clothing
Vocational	Boat	Warmth
Fire	Bicycle	Shelter
Home	Climbing	Food and Shelter

(Continued)		
<u>Safety</u>	<u>Travel</u>	<u>Camping</u>
Water	Hiking	Light
Play	Skating	Companionship
	Sledding	
	Train	
<u>War</u>	<u>Elements</u>	
Atomic	Floods	
Biological	Tides	
Chemical	Wind	
Bombing	Blizzard	

Survey I, Public Schools

Survey I was designed to ascertain the elements of survival education which were included in the curriculums of the schools contacted. Questionnaire postcards were sent to 800 city, county or district, and state officials. Responses were received from 353 of these officials.

Survey II, Public Schools

This survey was designed to show the courses and techniques used in the teaching of survival and to ascertain the administration of the coursework related to the subject. The survey was directed to those individuals who responded to Questionnaire I and had indicated that elements of survival were included in the teaching program. Three hundred questionnaires were sent and 137 responses were received.

Survey of Teacher-training Institutions

A questionnaire postcard was sent to 260 teacher-training institutions. The information requested was designed to show what elements of survival were taught, and the extent of the demand upon the institution for teachers trained in courses pertinent to survival. Sixty-five institutions responded.

Survey of Survival Material Contained in the Programs of the Boy Scouts of America and the Girl Scouts of America

A study was made of the Boy Scout and Girl Scout Programs to show that well organized youth programs existed which contained excellent survival programs and provided such education to a portion of our youth-population.

The investigation of survival education in the public schools demonstrated that this material as an integrated subject area is a new concept in public school education. Interpretation of this concept varied among school officials. A great diversity exists in the extent of inclusion of this material and serious omissions exist in this type of education, particularly in the areas covered by the topics, Camping, War and Elements.

A wide variety of courses contain survival material. Certain courses such as Health, Safety and Physical Education are most frequently employed in teaching this material.

The American Red Cross, the Civil Defense Board and the National Safety Council are important sources of teaching aids and survival material supplied to the

public schools. Passive means, Class Discussion and Posters, are most frequently employed as techniques in the teaching of survival. Responding officials recommended integration of survival material into existing curriculums as the best means of teaching the subject.

The majority of teacher-training institutions include some phase of survival education in their curriculums, however, it appears that the public schools place more importance upon such training than do the teacher-training institutions, with the exception of the field of camping. The teacher-training institutions prepare prospective teacher in the latter field far beyond the demand of the public school curriculum.

Awareness of the importance of survival education by the leaders of the Boy Scouts of America and the Girl Scouts of America is indicated by the extent of survival teachings included in the programs of each organization. These programs may well serve as models for the development of survival education curriculums in the public schools.

370 pages. \$4.63. MicA54-2927

INTERNAL STRUCTURE OF AN ELECTRONICS ACHIEVEMENT TEST EXAMINED BY A PRINCIPAL AXES ANALYSIS AND A HOMOGENEOUS CLUSTERING TECHNIQUE

(Publication No. 9144)

Lyman John Smith, Ed. D.
University of Illinois, 1954

A major purpose of this research was to study the internal structure of an electronics achievement test using a clustering technique developed by Loevinger, Gleser and DuBois, and also using a principal-axes factor analysis. Relevance of the Knowledge of Electronics test was determined by correlating subject's scores on the knowledge test with scores on a job-sample test of radar trouble-shooting.

Two samples of student electronics-technicians were used in this study. Three-hundred men responded only to the Knowledge of Electronics test. Fifty-seven men responded to the Knowledge of Electronics test and to the job-sample test of trouble-shooting. The sample of 57 was used as a validation and criterion sample.

The Loevinger method was applied to 40 items selected from the total 95 items composing the Knowledge of Electronics test. A homogeneous subtest of 30 items resulted. No residual cluster could be formed. By starting with two unrelated nuclei, two subtests were developed concurrently but correlated .48. An attempt to reduce the correlation between subtests was unsuccessful. Alphas for subtests ranged from .63 to .82. Shrinkage of subtest saturation on the validation sample was found to be slight.

By use of ILLIAC, a principal-axes factor analysis was made on 32 items chosen from the 40 items selected above. Two factors were significant beyond the 5% level; a third factor exhibited a P of .20, and was

carried forward in the analysis. Rotation was completed on 3 factors by use of the Quadrimax method. Factor scores were determined for individuals using unrotated principal-axes loadings.

The first rotated factor was clearly a general factor and expressed the overall, composite or average ability of the individual to handle the domain of subject matter defined by the Knowledge of Electronics test. The second rotated factor was named "Recall and Use of Common Formulae" and was interpreted as indicating a constant deviation above or below the student's general level of overall performance on items requiring the use of formulae. The third rotated factor was named "Current flow - Bi-polar." On this factor, individuals seemed to exhibit a negative relationship within their knowledge of current flow. A person who performed better than average on questions about current flow through vacuum tubes tended to find especial difficulty in answering current-flow questions that concerned components other than vacuum tubes.

Rotated Factor II was very similar to the 11-item Loevinger subtest but could be interpreted while the Loevinger subtest could not. Factor analysis seemed to have the advantage that items did not need to be interpreted on an all-or-none basis. Factor analysis permitted us to see which of the variables had the closest relationship to the factor. The Loevinger analysis made no distinction among items within a cluster. The assignment of items on an all-or-none basis was found to be inappropriate where the data deviated from a simple-structure model or when a general factor could not be removed by rotational procedures.

Scores from the total Knowledge of Electronics test predicted the job-sample criterion .34. Subtests developed by the Loevinger method and factors obtained by the principal-axes analysis all predicted the criterion more poorly than did the total knowledge test. 106 pages. \$1.33. MicA54-2928

TECHNIQUES FOR STUDYING PROGRAM DEVELOPMENT WITHIN A SCHOOL

(Publication No. 9563)

Yewell Reynolds Thompson, Ed. D.
University of Florida, 1954

The purpose of this study was to select or develop methods or techniques for studying program development within a school that would be briefer and more economical than those in ordinary use. It is a part of the first phase of the University of Florida Leadership Study. The Leadership Study was begun July 1, 1952, and is incorporated in the over-all research design of the Southern States Cooperative Program in Educational Administration which was initiated in 1951.

The major hypothesis of the University of Florida Leadership Study is that the qualities of personality and the working pattern of the official leader of a

school influence, to a major degree, human relationships, pupil achievement, program development, school-community relationships, and teacher activity. The first phase of the Leadership Study has been devoted to how-to-study techniques.

This study was based on an intensive investigation of program development in four selected schools. The schools were selected by the Research Staff of the Leadership Study, consisting of eleven faculty members and eight graduate students. The selections were made in accordance with a definite criteria which is outlined in the study.

The ten-month intensive study was preceded by a one-month preliminary investigation of desirable techniques and procedures to be used in the schools.

A number of research techniques were used in making the intensive study. These included: observations, interviews, examination of documentary materials, and a questionnaire.

It was hypothesized that a questionnaire would be an effective instrument for securing the same information as that obtained through the intensive study. The questionnaire was constructed in three parts - Part I, For the Principal; Part II, For the Teachers; and Part III, For Principal and Teachers. The steps and refinement procedures used in constructing the questionnaire are described in the study.

The information and knowledge gained by the graduate student members of the Research Staff and comparisons between the writer's responses and the responses by the principals and teachers in the four schools to the questionnaire were used to validate the instrument. The comparisons were made by computing the percentage of agreement between the writer and the teachers.

The percentage of agreement with the principals was never lower than 86.5, and with the teachers it was never lower than 64.7. The adjusted percentage of agreement, computed by eliminating all questions not checked by at least 25 per cent of the teachers, was never lower than 92.5 for principals and 85.7 for teachers.

By compiling the responses of the teachers according to the length of time they had been in school, it was found that teachers who had been in the school for a period of five years or longer had a higher percentage of agreement with the writer than the teachers who had been in the school for two years or longer or all the teachers.

A number of general conclusions were presented in the study. They were intended to serve as guides to others involved in similar research. Recommendations were made for the use of the questionnaire and other techniques in studying program development within a school. One of the most important final conclusions was, that the use of the questionnaire developed as a result of this study, together with interviews with principals and selected teachers and examination of certain documentary materials, constitutes a briefer effective method for studying program development within a school.

489 pages. \$6.11. MicA54-2929

EDUCATION, ADMINISTRATION

NATURE AND AMOUNT OF PRE-EMPLOYMENT
TRAINING NEEDED FOR ENTRY OCCUPATIONS
IN THE KANSAS CITY LABOR MARKET AREA

(Publication No. 9170)

Pat Herman Atteberry, Ed. D.
University of Missouri, 1954

Major Adviser: H. H. London

Purpose of Study: The purpose of this study was to ascertain the nature and amount of pre-employment training needed by workers in entry occupations in Kansas City, and the extent to which existing educational programs were meeting these needs.

Sources of Data: Data covering the number of occupational opportunities available to high school youth in Kansas City were obtained from the Seventeenth United States Census for 1950. Data dealing with the nature and amount of pre-employment training needed were secured by personal interview with 29 selected employers reporting on 118 entry occupations. Data on the extent of pre-employment training completed by Kansas City, Missouri high school graduates were collected from school records.

Summary: The number of youth 15 through 19 years of age in Kansas City in 1960 will be approximately double the number in this age group in 1950.

Kansas City youth below the age of 18 had little chance of full-time employment, since the majority of them were in full-time school. Their part-time occupational opportunities prior to age 18 were as casual workers in laborer, clerical, sales, and service jobs.

Clerical workers, predominantly female, are employed in all divisions of business and industry, and more workers are in clerical jobs than in any single occupation in Kansas City. Semi-skilled operatives and skilled craftsmen, predominantly male, are employed in manufacturing, construction, communication, transportation and public utilities, the second and the third largest occupational groups in the labor market area.

Recent trends indicate that increasing percentages of white male high school graduates will likely find jobs in the skilled trades and semi-skilled operatives, with decreasing percentages in sales and service occupations, whereas Negro males will probably go in increasing numbers into unskilled and semi-skilled operative jobs, decreasing percentagewise in the service occupations. Increasing numbers of white female youth will likely find employment in clerical and sales jobs, with diminishing numbers in the service occupations, while Negro females are moving into the service occupations and decreasing percentagewise in private household occupations.

Except in the skilled crafts, certain technical jobs, and clerical occupations, employers in

Kansas City attach little importance to specialized pre-employment training. They do want workers for entry jobs who can follow directions and assume responsibility, who are safety conscious, who have the "right attitude," who are willing to work, and who can get along well with others. The majority of entry jobs are only a first step in the occupational adjustment of youth, most of whom will find jobs up the ladder as they gain experience and grow older. The schools, therefore, must look, in the main, toward higher jobs and prepare youth through pre-employment and in-service training to move progressively toward these occupations.

While approximately 75 per cent of employers in Kansas City prefer beginning workers for entry jobs who are high school graduates, only approximately 50 per cent actually require this as a hiring policy. For beginning workers in the skilled crafts, certain technical and clerical jobs, employers prefer workers with at least two years of specialized pre-employment training.

For beginning workers in the semi-skilled operative jobs, employers preferred approximately one year of training of a general nature, involving a knowledge of common tools, materials and processes such as are provided in general education, including industrial arts.

White male high school graduates in Kansas City completing two years or more of day-trade training fell far short of the proportion of white males working in the skilled industrial occupations. Considerably larger proportions of white female high school graduates in Kansas City were completing two years or more of commercial education than the proportion of white females working in the clerical occupation.

Nearly 30 per cent of the Negro female high school graduates in Kansas City had completed two years or more of commercial education, while only 5 per cent of the Negro females were employed in clerical and office occupations.

210 pages. \$2.63. MicA54-2930

THE SELECTION AND INSTRUCTION OF
PUBLIC SCHOOL CUSTODIANS IN
SELECTED SCHOOL SYSTEMS

(Publication No. 9938)

Julius Ervin Barbour, Ed. D.
Michigan State College, 1954

The Problem. This study was concerned with the discovery of methods and criteria used in the selection of school custodians and of the methods and curricula used in the instruction of school custodians by selected Michigan school systems. Recommendations were formulated for the improvement of such selection and instruction on the basis of analysis of experience in other states.

Methods, Techniques, and Data. The questionnaire-interview method was employed as the technique

most appropriate for the problem. Questionnaires were discussed with school administrators and custodians during the first quarter of 1954. Data were collected relative to characteristics desired in custodians; information received prior to employment of custodians; methods used in employing and instructing custodians; and work experiences concerning which instruction was given to custodians.

Conclusions. Results of the survey revealed these major findings:

1. The school custodianship includes responsibility for the maintenance and upkeep of school property as well as for the cleaning of buildings and grounds.

2. Criteria of characteristics of desirable custodians have been established in many communities of the United States and these have been followed in some Michigan school systems in the selection of custodians.

3. The interview with the prospective custodian following his submission of a written application for the accumulation of additional information to use in the process of selection of custodians has been a procedure which has been used in most Michigan school systems.

4. The employment of custodians by verbal agreement was the method used in seventy per cent of the school systems of Michigan.

5. Employment of custodians began with a 30-60 day period of work on a probationary status in approximately one half of the school systems of Michigan.

6. Employment of custodians was recorded in the minutes of meetings of the boards of education of most Michigan school systems.

7. Federal, state and local agencies were asked by few Michigan school systems to refer to schools applicants for custodial work.

8. No one of the Michigan school systems included in the survey employed custodians from a list of candidates compiled by a civil service commission.

9. Less than one fourth of the school systems studied attempted to discover whether those applying for custodial work possessed licenses for boiler operation.

10. Nearly all of the Michigan schools' administrators had individual conferences with custodians for the instruction of these workers but many school systems needed to revise their methods of using printed material when instructing custodians.

11. Manuals of custodial work practices were compiled by committees of custodians as a learning experience in few Michigan school systems.

12. Very few Michigan school systems were found to have any custodians enrolled in correspondence course work concerning building maintenance or operation.

13. School systems of Michigan gave custodians instruction in seven phases of their work: public building cleaning, heating and ventilating, safety, public relations, floor care, building repair, and care of grounds.

Recommendations. Based upon the findings of this study, the following recommendations were made:

1. Investigation should be made of the effectiveness of various methods of instruction of custodians.

2. The application blanks now used by Michigan public schools should be revised.

3. A study is needed of the relationship between physical condition of and work accomplished by custodians.

4. The effect of possession by custodians of a written contract should be investigated.

5. The relationship of method of selection to efficiency of work done by school custodians should be studied.

6. Further study of methods of teaching custodians to utilize new products, new equipment and new methods of work should be made.

235 pages. \$2.94. MicA54-2931

AN EXPLORATORY STUDY OF RELATIONSHIPS EXISTING AMONG A PUBLIC SCHOOL PRINCIPAL'S BACKGROUND, SELF CONCEPT, ROLE CONCEPT, VALUES, AND PATTERN OF WORK

(Publication No. 9705)

Patricia Hadaway Carter, Ed. D.
University of Florida, 1954

The purpose of the study was to explore relationships existing among the self concept, role concept, values, background experiences, and ways of working of a public school principal; and to discover, if possible, a brief way of studying these factors in future research. Self concept, as used in the study, was a broad term to indicate how the individual looks at himself. Role concept was the way the principal sees his job. Values, as anything of worth to the individual, were studied as exhibited in operation by the principals. Ways of working were defined according to a companion dissertation of the exploratory phase of the research and, thus, interpreted as behavior demonstrated by the principal on the job. Background experiences, as used, were those considered relevant to the principal as an administrator.

Two types of data were collected for the study. One consisted of detailed observation, interviews, and nonstatistical data; the other concerned tests and devices that would yield results subject to statistical analysis. Both investigations were of parallel importance. One furnished information which added depth to the study and validation and penetration for accuracy of data; the other was a means of obtaining a brief but accurate method for isolating the factors being investigated in future research.

The data used in the intensive study of the four principals and in the examination of measuring instruments, based upon psychological and statistical analysis, indicate that relationships can be shown among the factors considered in the study. It is apparent that values, role concept, self concept, and background experiences contributing to these can be inferred from existing instruments and means of collecting data. The open-ended questionnaire, as used, yields

worth-while information concerning the principal's ways of working and his authoritarianism; the Occupational Preference Scale (developed for this study) has possibilities as a measure of authoritarianism; and the Index of Adjustment and Values provides worthwhile data in the areas of self concept, role concept, and values. With these indications, further research in the areas investigated should prove fruitful.

Upon the basis of the results of this research, the following suggestions are made for future related research:

1. For study of an individual principal or a small group of principals, the method of intensive study is recommended. As this method makes use of available material, more information and many different kinds of data may be secured through this type of research; and interrelations can be determined after the data have been organized, condensed, and classified. Observation of the principal "on the job," examination of written materials, and interviews with many people form the basis for such an intensive study; however, at least one personality inventory should be used in conjunction with the other data (the Guilford-Martin Personality Test, GAMIN form, is recommended). As a test of authoritarianism, the Occupational Preference Scale is recommended because of its ease of administration, ease of scoring, and its apparent measurement of the inclination of a person to be in control of people. The open-ended questionnaire is likewise recommended.

2. In some cases in which the groups are very large, and time and the size of the group make intensive study of the principals impossible, or at least undesirable, paper-and-pencil form become the basis for the research. The open-ended questionnaire replies, ranked by a competent jury, and the Occupational Preference Scale seem to be useful and though further research is indicated, these instruments, the writer believes, can be adequate enough to give a fair picture of the principal's values, self concept, role concept, and ways of working within his school. Their contribution to the support of the data of the intensive studies indicate the possibilities of their use in further research. 257 pages. \$3.21. MicA54-2932

A JOB ANALYSIS OF THE VOCATIONAL HIGH SCHOOL PRINCIPALSHIP

(Publication No. 9911)

Burr Deline Coe, Ph. D.
Cornell University, 1954

The Problem

The rapid growth and increased complexity of modern secondary education has increased the importance of the vocational high school principalship as a professional position. The purpose of this study is to analyze the job of the vocational high school principal; his duties, responsibilities, and activities. It is not an evaluation of his performance but a fact-

finding study of what he does, how he does it, when he does it, and why he does it.

The study also analyzes the qualifications for the vocational high school principalship, present status of vocational high school principals, their working conditions, relationships maintained, specialized knowledges and skills required, and pertinent data concerning the schools and communities in which they serve.

Procedure

Principalships in three types of vocational school systems were studied; a state system of vocational schools, a county-unit system, and city school systems. Nine principals were carefully selected to insure a representative sample, from the states of New York, New Jersey, Connecticut, and Pennsylvania. There were eight men and one woman in the group studied. All of the principals serve in specialized vocational and/or technical high schools which qualify for reimbursement under the various Federal Acts for Vocational Education.

Data for the study were gathered principally by personal interview, using an interview worksheet developed on the basis of pilot interviews. The principals were interviewed in their own schools, while school was in session. The interview data were checked with higher school authorities, other personnel in the schools, and administrative bulletins and publications of the schools involved.

The complete job analysis summarizes the data gathered under seven major headings; (1) Duties and responsibilities of the vocational high school principal, (2) Organizational relationships of the vocational high school principal, (3) Physical demands of the vocational high school principalship, (4) Specialized knowledges and skills required by the vocational high school principalship, (5) Personal data concerning the principals, (6) Data concerning the schools administered, and, (7) Data concerning the cities in which the schools are located.

Findings

1. Many of the functions of the vocational high school principal are substantially the same as for any secondary school principal.

2. The vocational high school principal has many duties and responsibilities which are unique to the vocational high school, especially with respect to plant facilities, equipment and supplies, and supervision of instruction in the shop and related subjects.

3. The vocational high school principal has many relationships outside of the school which are unique to the vocational high school.

4. Many of the working conditions are unique to the vocational high school.

5. Many specialized knowledges are required of the vocational high school principal but the administrative skills are the same as required of any school administrator.

6. The principals studied all had had considerable work experience in industry before entering the teaching profession, had risen from the teaching ranks in the vocational schools, and had been unusually

professionally alert, and had had specialized training and experience for their jobs.

7. The professional status of the vocational high school principal in terms of salary, tenure, retirement benefits, and the like is comparable to the status of other secondary school principals.

Conclusions

1. The vocational high school principal needs to have the same background in the area of general education as any school administrator should have.

2. Because of the many highly specialized duties, responsibilities, relationships, and knowledges required, the vocational high school principal needs to have work experience in industry or some trade or technical occupation and specialized training and experience in vocational, technical, and/or practical arts education. 429 pages. \$5.36. MicA54-2933

THE INCIDENCE OF CERTAIN FACTORS RELATING TO DROP-OUTS FROM THE 1948-52 CLASS AT THE UNIVERSITY OF MISSOURI

(Publication No. 9174)

Clifford Lee Corley, Ed. D.
University of Missouri, 1954

Purpose: The primary purpose was to investigate certain factors relative to drop-outs from the University of Missouri during the period 1948-52. Supplementary to this major problem was the study of the 1948 freshman class and its resultant disposition during the normal degree period.

Method of Research: The total group was divided into four groups - graduates; non-graduates, currently enrolled; apparent transfers to other institutions; and apparent drop-outs. The last group was considered with respect to: high school rank; Ohio State University Psychological Test scores; Cooperative English Test scores; sex; age; parental occupation; high school size; academic achievement in the University; and educational service agency contacts. Data were obtained from the files of the Admissions Office, Missouri College Aptitude Testing Program, University Counseling Bureau, Reading and Study Skills Clinic, Personality Clinic, and Student Financial Aids Office.

Major Conclusions: Of the group of Missouri high school graduates who began as freshmen in the Fall semester 1948, 30.7 per cent had graduated, 12.1 per cent were in school, 12.2 per cent apparently transferred, and 45.0 per cent apparently dropped out by the Fall semester 1952. The points of most serious mortality were in the first two years, with 50.3 per cent of the drop-outs leaving by the end of the first year and 77.4 per cent by the end of the second year.

When the drop-outs were considered with respect

to their academic backgrounds, they were not a select group of students. There was a uniform distribution among upper, middle, and lower third class rank, but the scores on the standardized tests considered tended to cluster toward the lower end of the scales and the median scores were lower than the median scores of the norms used. Over three-fourths of these students had less than an average grade-point record in the University. Record card notations revealed that 27.9 per cent were admitted from high school on scholastic probation, 38.2 per cent were on college probation at some time, and 18.3 per cent were apparently required to withdraw due to academic deficiencies. However, with reference to each of the criteria, it was apparent that a number of potentially capable students also dropped out.

In terms of number of semesters attended, other factors than those considered would appear to be operating with respect to the early mortality of the students who dropped out. For example, women students appeared to be a more select group scholastically, but withdrew earlier. The older students appeared less scholastically capable, and withdrew in greater numbers earlier. On the whole it appeared that students with less scholastic ability, as measured by the criteria selected, tended to drop out in greater percentages earlier; however, a considerable percentage of potentially capable students withdrew during the same periods studied. The students in this group appeared to withdraw heavily during the first two years, regardless of their scholastic ability or academic achievement.

The students who apparently dropped out did not appear to have availed themselves of the educational service agencies provided. Official excuses were available on only 25.5 per cent of the drop-outs. Although a greater percentage of these students with unsatisfactory records appeared to have contacted available personnel services than did students with satisfactory records, more than half of both groups had apparently made no contacts.

It would appear that the University of Missouri could better serve its students, the people of the state, and society in general by a continuous study of student mortality and means by which these students could be assisted either to remain in school and achieve maximal success, or adjust to a necessary decision to withdraw.

253 pages. \$3.16. MicA54-2934

AN EVALUATION OF THE PROCESSES USED IN A CURRICULUM PROGRAM

(Publication No. 10,052)

A. Raymond Ebaugh, Ed. D.
Wayne University, 1954

Prior to the late 1940's there was a variety of sources which described and analyzed then current curriculum programs. These materials proved of value in appraising new developments and spreading good practice. It is to serve a similar purpose that

this description and evaluation of the processes used in the Royal Oak (Michigan) Curriculum Study was written.

This study describes and evaluates the processes used by four groups, namely: (1) the administration and board of education which in 1946 contracted for "A Study of Public School Building Needs"; (2) a study group of thirty-five professional staff members who worked together in 1946-47; (3) a three-week workshop held in the summer of 1947; and (4) nine groups of professional staff personnel which met simultaneously twice a month in 1947-48. Following these descriptions and evaluations is an account of the curriculum activities pursued in Royal Oak during the three years immediately following. Conclusions concerning success or failure of the processes used during the study and other related findings are drawn from the materials.

The specific purposes of this study are to describe the processes used throughout the three years of the Royal Oak Curriculum Study; to evaluate these processes in the light of criteria covering the major areas of present day curriculum development work; to describe the processes used in curriculum activities during the three-year period immediately following the Royal Oak Curriculum Study; and to indicate implications for curriculum directors, curriculum participants, and boards of education.

Sources of data are categorized under three headings, namely: documentary, questionnaire and personal observation. These data disclose that the professional staff had a small minority of its members who were interested in and who had a readiness to do curriculum work; that one of the first considerations in the curriculum program was a statement of educational aims by the curriculum director without co-operative enterprise; that teaching and learning suggestions were consistently based upon sound principles of learning, mental hygiene and personality development; that the organization for curriculum work took into account the problems and needs of the school system; that adequate channels of communication were not established; that there was not supporting evidence to show that teacher-growth was considered the primary avenue of curriculum improvement; and that the individual school was not considered the unit of curriculum improvement.

Implications for curriculum directors as ascertained from the data show decisively that provision should be made for the conscious fostering of group purpose; that the philosophy of education be an outgrowth of co-operative enterprise; that the administrative organization be consistent with conceptions of the curriculum; that the "grass roots" approach in curriculum work be used; that lay citizens be included in curriculum work; and that a curriculum director be sensitive to the time element and its implications for desirable curriculum progress.

The implications for curriculum participants lie in the demonstration of the fact that attitudes can be changed and new skills and techniques can be learned through in-service education; that there must be a united effort among all members; and that co-operative planning between staff, director and parents is

more certain to produce desirable results than the "directives" approach.

Implications for boards of education center on the implementing of practices in curriculum work which are invested in their power. Specific implications for boards of education are employing competent personnel; voting sufficient funds to compensate adequately these personnel; providing released time for curriculum work; making provision for attendance of staff members at conferences; encouraging the use of effective consultant service; keeping the public informed about curriculum work; and seeing that individual board members refrain from entering into matters of routine operation which should be under the sole direction of the executives employed for that responsibility. 232 pages. \$2.90. MicA54-2935

FINANCIAL IMPLICATIONS OF A TYPE OF SCHOOL DISTRICT REORGANIZATION IN NEBRASKA

(Publication No. 9845)

Neal Sidney Gomon, Ed. D.
University of Nebraska, 1954

The purpose of the study is to analyze the financial implications of a type of school district reorganization in Nebraska. The type proposed is not the ultimate or ideal pattern but is believed to be a major step in the direction of a more efficient organization of the school districts.

An examination was made of the accredited and approved Class II and Class III districts and their contiguous Class I districts during the 1952-53 school year in terms of their financial ability to support a school program and the financial effort made by the districts to provide educational opportunities.

Using the information gathered for the consideration of the first phase of the study, a reorganization of all districts involved in the study was planned by attaching to each Class II or Class III districts its contiguous Class I districts.

Such reorganized districts were then studied in terms of their ability to support schools and the financial effort necessary to provide the same resources for the proposed reorganized districts as was available to the individual districts, as well as the significance of student population within the proposed reorganized districts.

The sources of information for the study were the official records of the county superintendents of schools, the county treasurers, the city superintendents of schools and the State Department of Public Instruction. By using four sources of information it has been possible to triple-check the information on valuations and mill levies and double-check all remaining information for the study.

No attempt has been made to group districts according to natural community boundaries. The number of Class II and Class III districts included in this study is 391, or 85 per cent, of the total number

of such districts together with 2,064 contiguous Class I districts.

This study reveals extensive inequalities of ability to support educational programs at all levels of educational activity among the school districts of the state. The study also reveals the effort made to provide educational opportunities varies to an even greater extent than does the financial abilities of the districts.

A reorganization of school districts in the state which would attach to existing Class II and Class III districts their contiguous Class I districts would reduce, in a measure, the inequalities in abilities to support educational programs as well as the inequalities of effort to provide such programs. Increases in enrollments would be slight among a majority of the Class II and Class III districts.

Because the present pattern of school district organization is providing wide variations in educational opportunities for the future citizens of the state and at the same time is creating wide variations in the tax load carried by the people, the following recommendations are made:

The state legislature should give early consideration to (a) a program which would unite into single administrative units present efficiently organized Class II and Class III districts and their contiguous Class I districts, (b) further study of present contractual relationships between elementary and high school districts with a view to the immediate elimination of these inequitable and undemocratic practices, (c) a study of those districts which neither maintain schools nor contract for instruction with a view to the immediate elimination of such districts and, (d) an analysis of existing financially and educationally unsound Class II and Class III districts with a view to their proper reorganization.

Further study should be made of the merits of the suggested plan of reorganization in terms of the most defensible state-wide program of reorganization for all districts in the state.

The educational profession within the state should become thoroughly familiar with the existing situation and should demonstrate the high type of professional leadership in public relations essential to the proper solution of this major problem of school district reorganization in the state.

350 pages. \$4.38. MicA54-2936

**AN EVALUATION OF THE ORGANIZATION,
ADMINISTRATION, AND FINANCING OF THE
EXTENDED PUBLIC SCHOOL PROGRAM FOR
METROPOLITAN AREAS OF FLORIDA**

(Publication No. 9724)

Louis P. Gregory, Ed. D.
University of Florida, 1954

There has been an increasing tendency over the nation during recent years to extend the nine-months school term to include a summer enrichment program. The Minimum Foundation Program has made

it possible for many Florida counties to offer summer enrichment programs – activities of a largely non-academic nature. The attendance period and program are optional with pupil participants.

These Florida programs have been in operation for some time and a systematic evaluation would seem to be appropriate – hence this study which has as its purposes: (1) to identify administrative factors which influence the program, and (2) to evaluate the program in terms of the achievement of common specific objectives as agreed upon by the supervisors of the extended summer programs for the selected counties of Florida. The five metropolitan counties of Florida were selected for extensive study because these counties all had extensive summer school programs.

The five metropolitan counties of Florida, Dade, Duval, Hillsborough, Orange and Pinellas were selected for study. Data were gathered by means of visitations, interview, check lists, and official records. A number of check lists were developed for the purposes of identifying the objectives of the program, identifying the activities, appraising the contribution of activities to the attainment of objectives, and appraising the contributions of administrative and financing provisions for the program.

Activities in the summer programs were rated by county supervisors and by instructors for the extent to which each contributed to a list of objectives agreed to by all the county supervisors. When these judgments were combined camping was rated highest followed by arts and crafts, sports and games, library, singing, social games, instrumental music, dramatics, homemaking, folk dancing and aquatic sports. Instructors who were closer to the program tended to give higher ratings than supervisors.

A random sample of parents of participating children reported favorably on the program. Despite this only 50 per cent of the children in the appropriate age groups participated in the county with the best drawing program and participation dropped off to 20 per cent in the lowest ranking county.

Administratively it is recommended that the program can be improved by an in-service training which should be provided for the teachers and supervisors involved in the summer program. The staff should make more use of community and civic leaders.

Since the success of the extended school program depends a great deal upon the full utilization of total community resources, careful planning is vital to the success of the program. Planning should involve all persons concerned with the program including teachers, supervisors, principals, superintendents, board of education, county officials, parents and pupils.

Parents should be informed about the summer program through all available publicity media in order that more children may be reached. Additional funds should be provided for some activities and facilities.

212 pages. \$2.65. MicA54-2937

A STUDY OF THE PUBLIC SCHOOL RETIREMENT SYSTEM OF MISSOURI

(Publication No. 9180)

Byron Wiseman Hansford, Ed. D.
University of Missouri, 1954

Major Adviser: A. G. Capps

PURPOSE: To study the Public School Retirement System of Missouri to determine its strengths and weaknesses and to make recommendations for changes where changes seem to be desirable.

METHOD OF RESEARCH: Data were obtained chiefly from material furnished by the administrators of the Public School Retirement System of Missouri and other state retirement systems. In cases where such information was not sufficient data were taken from the laws of the several states.

SUMMARY:

- (1) The development of the state-wide teacher retirement movement in Missouri covers a period from about 1896 to the present. The major efforts prior to 1937 were directed toward removing the constitutional barrier which prohibited state-wide teacher retirement systems. The efforts from 1937 to 1945 consisted largely of attempts to secure legislation implementing a retirement system. Since 1945 efforts have been made to improve the existing teacher retirement system.
- (2) With regard to membership state retirement systems for teachers fall generally into two categories. Some systems include teachers with other state employees. These systems may be called Public Employee Retirement Systems. Other systems are established primarily for the retirement of teachers but they may also include other school employees. These systems may be called Teacher Retirement Systems.
- (3) The practice of having retirement systems under the administrative control of a retirement board is one of the most commonly accepted practices among the retirement systems of the various states.
- (4) Retirement systems of today are conducted on much the same principle as insurance companies in-so-far as the members' contributions are concerned so that the amount contributed by any member has a direct relation to what the member may expect to receive from the system in the way of benefits. More than half of the states have retirement systems which require larger contribution rates from the members than the Missouri system requires.
- (5) Member benefits from forty-six of the forty-eight states are based on public contributions as well as the member contributions. On the basis of the amounts quoted, it seems that at

least 50 per cent of the states have maximum service retirement benefits which may be as high or higher than those of the Missouri system.

- (6) An examination of the literature discloses several sets of principles for retirement systems, three of which have been used as a basis of comparison for the Missouri system. The Missouri Public School Retirement System compares favorably with principles found to be desirable for retirement systems.

RECOMMENDATIONS:

- (1) In order to increase the benefits which can be paid to the members the rate of contribution should be raised.
- (2) The limitation of 5 per cent of \$4800 as the maximum contribution should be removed to provide more flexibility to the system for meeting unusual economic circumstances.
- (3) In order to prevent the promised benefits from the retirement system from being reduced it is recommended that the benefits be quoted as being the actuarial equivalent of the member's accumulated contributions plus matching benefits from public funds.
- (4) One of the greatest limitations of the Public School Retirement System of Missouri is the lack of adequate provisions for reciprocity with other state systems. In order to partially remove this limitation it is recommended that fully paid deferred annuities be granted on the basis of ten years of membership service instead of thirty years of service as is now the practice. Such deferred annuities should be granted for each ten years of membership service and should include benefits from both the member contributions and the district contributions. 235 pages. \$2.94. MicA54-2938

A STUDY OF CERTAIN SCHOOL-COMMUNITY RELATIONSHIPS WITH SPECIAL REFERENCE TO WORKING PATTERNS OF SCHOOL PRINCIPALS

(Publication No. 9712)

Lee Gibbons Henderson, Ed. D.
University of Florida, 1954

This study was developed within the matrix of the University of Florida project of the Southern States Cooperative Program in Educational Administration.

The study was designed to test the hypothesis that there is a relationship between the behavior pattern, or way of working, of the school principal and the school-community relationships existing between the school and its community. The study was conducted in forty-eight selected schools in Hillsborough County, a large metropolitan county centrally located on the west coast of Florida.

Data was gathered by use of parent and teacher questionnaires developed in an earlier phase of this project. The Parent Questionnaires were distributed to a random sample of approximately 150 parents from each of the forty-eight schools studied. Of the 7,285 Parent Questionnaires distributed 5,962, or 81.8 per cent, were completed and returned in a usable condition. The Teacher Questionnaires were distributed to each of the 1,123 teachers in the schools studied and 95.8 per cent were completed and returned. The responses to the Parent Questionnaire were punched into IBM cards, and machine tabulated and analyzed, while the responses to the Teacher Questionnaire were hand tabulated to give summaries of responses from each of the forty-eight schools.

By use of data from a related study by E. W. Van Aken two groups of schools were selected for comparative purposes. One group was composed of the twelve schools whose principals tended to be most authoritarian in their way of working, while the second group was composed of the twelve schools whose principals tended to be the most democratic in their way of working.

The study compared the responses of parents from the two groups of schools and, because the groups were composed of different types of schools, from the elementary schools in the two groups. These comparisons revealed significant differences between the two groups not only in opinion and feelings about the schools but also in income, education of the parent and distance lived from the school.

Further analysis revealed a relationship between each of the latter three variables and feelings of parents about the school. Two techniques were used to equate the effects of these three variables. First, all responses from each group of schools were categorized according to all three variables and responses from each group in each category were compared. Second, 461 pairs of parents matched on all three of these variables were obtained and responses from each group were compared.

The final step in the study was to compare responses to the Teacher Questionnaire of teachers from the two total groups and from the elementary schools in each group.

It was concluded that the behavior pattern of the school principal does seem to have an influence on how parents feel about the school, but seems to have little if any measurable influence on the teachers' feelings about the community, or on the interaction of the school as a whole or on teachers as individuals with the community. Increasing frequency of democratic behavior on the part of the principal tends to result in parents holding a more favorable opinion about the school and, to a lesser degree, having more interaction with the school.

Evidence in this study indicated that there is an inverse relationship between favorable feelings about the school and distance lived from the school. It was also noted that, generally speaking, the higher the income and education of the parent the higher were his desires for schools and the greater was his contact with his child's school.

246 pages. \$3.08. MicA54-2939

CHARACTERISTICS OF TEACHER
PARTICIPATION IN DECISION-MAKING
FUNCTIONS OF PUBLIC-SCHOOL
ADMINISTRATION: AN EMPIRICAL
INVESTIGATION OF TEACHER
PARTICIPATION IN POLICY-MAKING AND
RELATED FACTORS IN FOUR ILLINOIS
PUBLIC-SCHOOL SYSTEMS

(Publication No. 9089)

Darrell James Inabnit, Ed. D.
University of Illinois, 1954

This study investigated empirically correlates and variants of participation as reflected in the participation of teachers in decision-making functions of public-school administration. The subjects were 112 non-rural, public-school teachers in 4 Illinois community-unit districts.

The importance of participation in educational policy-making has been recognized in five emergent emphases in education: (a) the movement for increased democracy in educational administration, (b) the recognition of the significance of the adaptability concept, (c) the emphasis on group dynamics in educational planning, (d) the action-research movement, and (e) the emphasis on citizen cooperation in educational policy-making.

Organization theory provided the orientation for viewing the participation of teachers in administrative decision-making. Organization is viewed as a cooperative system of individuals, specialized in operations, requiring coordination and administration. Decision-making is a function of organization, with the executive specializing in decision-making and with the responsibility for decisions an institutionally prescribed function of the executive along with the inherent function of coordination.

Participation is a complex phenomenon involving (a) differences in the organizational environment, (b) differences in characteristics of the individual participants, resulting in (c) differences in patterns of participant behavior, and (d) differences in the behavior of individuals as operatives. These clusters of variables were related in a participation model, and measures of each were obtained for use in the statistical analyses in testing several hypotheses.

In examining the relationships between teacher behavior in participation and teacher behavior in operation, it was found that the amount of teacher participation in decision-making was not necessarily related to teacher satisfaction or teacher effectiveness in classroom operation. School systems with the greatest amount of participation were not necessarily those with the highest teacher satisfaction. There was no evidence that activity in participation was of any direct consequence in the quality of the educational program as reflected in the teachers' classroom operation.

An examination of certain relationships between teacher characteristics and teacher participation in administrative decision-making pointed to the complexity of participation and the absence of simple and direct determinants of participant behavior. Gross

measures of personality characteristics indicated that some individuals participate differently because of greater need for participation. Characteristics of the professionalization of the teacher, such as amount of formal education, attitudinal adjustment to the profession, or commitment to the system, were not useful in the prediction of the amount of participatory behavior.

Relationships between the subject matter of decision and characteristics of participation were examined. Teachers' participation on school problems which are recurring and continuous was characterized by more activity and greater responsibility than was participation on areas labeled "infrequent." In participation in decision-making relative to problems proximate to teacher experience, teachers tended to be more active, to accept more responsibility, to interact more with administrative centers, and to exert more influence than in participation related to problems remote from the teachers' day-to-day activities. The subject matter of decision, as categorized in this study, did not have a statistically significant relationship to the satisfaction an individual teacher experiences relative to his behavior in participation, although significant relationships existed relative to specific problem areas.

In examining certain relationships between organizational variables and teacher behavior in participation and operation it was found that it was not what the teacher did in participation that mattered but it was his perception of the environment for decision-making. Teachers whose professional orientation was in consonance with accepted educational thinking were more satisfied if participating in systems where the responsibility dispersion and administrative behavior in decision-making indicated shared authority. The extent to which teachers perceived that their participation was effective depended upon the structural environment more than upon teacher satisfaction.

186 pages. \$2.33. MicA54-2940

AN APPLICATION OF THE SCIENTIFIC ATTITUDE TO SOME OF THE REQUIREMENTS, PRACTICES AND OBJECTIVES OF THE DOCTORAL PROGRAM

(Publication No. 9553)

William Byrl McBride, Ed. D.
University of Florida, 1951

A dichotomy appears to exist in the function and purpose of the American graduate school. The process by which it operates appears to be largely accepted from traditional foreign patterns, although one of its basic tenets is promotion of the scientific attitude. The purpose of this study is to determine the extent to which selected doctoral requirements, practices and objectives are established by the scientific attitude.

To solve this problem the scientific attitude is described, phases of the doctoral program are chosen to be studied, the selected phases are

described from an historical and a status point of view, the scientific attitude is applied to the selected phases and from the data collected conclusions and recommendations are drawn. Data are obtained from 120 graduate deans, graduate school bulletins and various other sources.

The major findings are: science is used little in establishing the requirements, practices and objectives; officials appear to be confused over the objectives of the doctoral program; graduate schools do not collect data generally as a basis for improving programs; there is insufficient evidence finally to accept or reject the universally applied language requirements, but the present data tend to reject them; programs of study appear to be narrowly conceived; and there is some movement to include preparation for college teaching as an integral part of programs of study.

241 pages. \$3.01. MicA54-2941

THE NATURE AND ROLE OF THE INTERMEDIATE DISTRICT IN AMERICAN EDUCATION

(Publication No. 9846)

Archie LeRoy McPherran, Ed. D.
University of Nebraska, 1954

Adviser: Leslie L. Chisholm

The purpose of this study was threefold: (a) to determine the nature and role of the intermediate district, (b) to determine the trends in its organization and administration, and (c) to develop criteria as the basis for an index to evaluate the potential adequacy of intermediate school districts in seven selected states.

The following five steps were followed in developing the study: (1) the conducting of a survey of the literature, (2) the securing of data from state departments of education, (3) the selecting and developing of six criteria, which, in turn, were used in the developing of an index, (4) the validation of the index using data from several representative counties, and (5) the selecting of states to be evaluated and applying the index.

The counties in California, Colorado, Iowa, Kansas, Nebraska, South Dakota, and Wyoming were selected for evaluation by use of the index. From the study it was concluded that:

1. To be completely self-sufficient in the provision of an educational program that includes specialized educational services, a local school district should have a minimum pupil enrollment of 1,500 or a minimum total population of 7,500.

2. The minimum staff-pupil enrollment for each class for the partially sighted, homebound, and orthopedically handicapped is eight; mentally gifted, twenty; delicate, fifteen; socially maladjusted, fifteen; mentally retarded, twelve; deaf and hard of hearing, nine. There should be a minimum of 100 pupils served by each speech correctionist; nurse, 800

pupils; dental hygienist, 2,000; guidance counselor, 1,200; psychologist, 3,000; supervisor of transportation, 700; supervisor of instruction, 750; supervisor of attendance, 2,000; audio-visual director, 4,000; adult education director, 4,000; and vocational education supervisor, 4,000.

3. The maximum teacher-pupil enrollment for the partially sighted is twenty; homebound, eighteen pupils; delicate, twenty-five; mentally gifted, thirty; orthopedically handicapped, eighteen; nurse, 1,200; dental hygienist, 3,000; guidance counselor, 3,000; psychologist, 6,000; supervisor of instruction, 1,250; and supervisor of attendance, 2,500.

4. An intermediate school district requires a pupil enrollment of 10,000 or a total population of 50,000 to have the potentiality necessary to provide, at reasonable cost, a maximum program of specialized educational services to local school districts.

5. An intermediate district requires a pupil enrollment of 4,000 or a total population of 20,000 to be potentially adequate in the provision of a modified-maximum program of services.

6. An intermediate district requires a pupil enrollment of 2,000 or a total population of 10,000 to have the potentiality necessary to provide a minimum program of services. Those districts which have less than 2,000 pupils or 10,000 in total population are inadequate to function effectively as intermediate districts.

7. Of the 508 counties in the seven selected states, twenty-six counties have the potentiality to provide a maximum program, sixty a modified-maximum program, and 176 a minimum program of specialized educational services.

8. Of the seven states studied, only California and Iowa have a majority of counties with the potentiality to function as intermediate districts in providing even a minimum program of specialized services. Five of the fifty-eight counties in California, forty-two of the sixty Colorado counties, five of the ninety-nine Iowa counties, sixty-six of the 105 Kansas counties, fifty-seven of the ninety-three Nebraska counties, and seventeen of the twenty-three Wyoming counties are inadequate to function as intermediate school districts.

9. In so far as the findings of this study are valid, the states of California and Iowa can retain their counties as intermediate districts without extensive change in their administrative structure. The majority of counties in Colorado, Kansas, Nebraska, South Dakota, and Wyoming will need to undergo extensive reorganization in order to provide effective intermediate district services in those states.

322 pages. \$4.03. MicA54-2942

A STUDY OF THE EXTENT OF RESPONSIBILITY DELEGATED TO NEBRASKA PUBLIC SCHOOL SUPERINTENDENTS BY BOARDS OF EDUCATION

(Publication No. 9696)

Edward Burton O'Connor, Ph. D.
University of Nebraska, 1954

The purpose of this study was to determine the amount of responsibility delegated to Nebraska public school superintendents in all aspects of school administration by boards of education. A secondary purpose was to determine if superintendents of larger schools were delegated more responsibility than those of smaller schools. The study included an investigation of the literature dealing with the division of responsibilities between superintendents and school boards. Recommendations were made based on the findings of the study and from suggestions found in the literature.

The first phase of the study was to develop a questionnaire to be sent to the superintendent and to the school board secretary of every public school in Nebraska, exclusive of Class I schools. The questionnaire developed and sent contained seventy-eight administrative items divided into six major divisions. These were organization and control, school plant and equipment, finance, pupils, curriculum, and employees. Space was provided so that one of three possible answers could be checked for each item of administration indicating (1) that the board of education retained the responsibility, (2) that the board of education delegated the responsibility to the superintendent, (3) that the board of education and superintendent shared the responsibility. Questionnaire responses from 226 school board secretaries and 359 superintendents were received and the information from these reports was used in the study.

The second phase of the investigation was a thorough review of the literature to ascertain what authorities indicated should be the responsibilities of superintendents. This information was then compared with that received from Nebraska superintendents and school board secretaries. Information received from superintendents and school board secretaries of the same school was also compared to see if differences of opinion existed as to the extent of the superintendent's responsibility.

The following statements summarize the findings of this study:

1. School boards should act as legislative and judicial bodies; superintendents should be the executive agents.

2. Boards of education should seek and elect competent executives to the office of superintendent, and with the election of such, delegate the complete responsibility to act as the executive officer in the administration of the school.

3. School boards are obligated to refrain from interfering with the execution of its policies to an extent that will make it impossible to hold the superintendent responsible for results.

4. Generally speaking, legislation should deal with principles; requirements should be general rather than specific; and the methods of effecting the required results should be left to the superintendent.

5. Written school board policies setting forth the division of responsibilities are essential to eliminate misunderstandings and disagreements between superintendents and school boards.

6. School board policies should not be filed away to become obsolete and forgotten, but should be kept current and subject to modification as time and necessity demand.

7. Each school board member and each superintendent should make himself thoroughly familiar with the board policies.

8. The size of the school should not be a factor in the delegating or retaining of responsibility by boards of education.

9. Boards of education of larger Nebraska schools delegate more responsibility to superintendents than those of smaller schools.

10. Nebraska boards of education delegate less responsibility in the following areas of administration: finance, school plant and equipment, organization and control, and employees.

11. Nebraska boards of education delegate more responsibility in the areas pertaining to the pupils and the curriculum.

12. Differences of opinion in regard to the division of responsibilities between superintendents and school boards do exist in some Nebraska public schools.

235 pages. \$2.94. MicA54-2943

FACTORS INVOLVED IN THE RECRUITMENT AND RETENTION OF TEACHERS IN MICHIGAN

(Publication No. 10,057)

James Nelson Pepper, Ed. D.
Wayne University, 1954

Problem

The study is concerned with an analysis of the factors involved in the recurring shortage of teachers each year in the public schools of Michigan. The investigation attempts to determine through available research (1) the distinguishing features of the teacher supply-demand problem in Michigan; (2) the feelings and attitudes of teachers, students, and parents toward the teaching profession as revealed by recent studies in related fields; and (3) the opinions and attitudes of former Michigan teachers, who taught five years or less in regard to (a) teacher status, (b) the teaching profession, (c) administrative relationships, and (d) community relationships.

Procedures

The investigation is based upon data obtained through (1) a review of related research appearing in current professional literature, and (2) questionnaire

returns from 210 representative rural and urban teachers in Michigan who left the teaching profession at the close of the school year 1951-1952 after having taught five years or less.

Major Findings

1. Slightly over 40 per cent of the former Michigan teachers, who taught five years or less, left teaching for reasons other than those of a financial nature. A large majority of the women teachers gave home-making, maternity, or marriage as reasons for leaving the profession. The men teachers, however, considered the lack of economic opportunities as the most important reason for leaving teaching. Other reasons given by the teachers centered largely around tensions and pressures connected with the administrative, school, or community situations.

2. Forty per cent of the men teachers who taught five years or less, indicated an interest in remaining in the profession until retirement if the economic inducements had been greater. Of the men who reported their present incomes, a great majority indicated salaries averaging one thousand dollars a year more than they received while teaching.

3. Attitudes and opinions of a negative nature expressed by a large number of the former teachers revealed that: (1) most ex-teachers do not desire to return to teaching, (2) only a small percentage of the men teachers would choose teaching again, (3) most women teachers feel that teaching offers limited opportunities for marriage, (4) teachers do not consider the cultural advantages of teaching as great as is generally publicized, (5) communities in general do not accept teachers as permanent members of the community, (6) communities generally show only a mild interest in the housing problems of teachers, and (7) most teachers feel that they are more restricted socially than are members of other leading professions.

4. Attitudes and opinions of a positive nature expressed by a large number of the former teachers indicated that (1) teachers in general enjoy working with pupils and fellow teachers, (2) a majority of teachers believe that young people should be encouraged to become teachers, (3) most teachers desire to maintain high professional standards, (4) many teachers desire to participate in important school policy formation, (5) many teachers desire to participate in community activities, and (6) most teachers rate their profession high from a social prestige standpoint.

Major Recommendations

1. Lay and professional groups should put forth increased efforts toward improving the present system of tax assessments in Michigan.

2. Continued efforts should be made on the part of professional and state agencies to help school boards function more effectively.

3. Local school administrators should encourage more teacher participation in important school policy formation.

4. In-service training programs should be

extended as a permanent part of the educational planning of local school systems.

5. Administrators should help communities to understand the problems of teachers through a continuous program of public relations.

6. A state-wide selective recruitment program should be organized to include the coordinated efforts of public schools, colleges, professional organizations, and central state agencies.

196 pages. \$2.45. MicA54-2944

THE RELATIONSHIP BETWEEN SCHOOL DISTRICT ORGANIZATION AND PUBLIC SCHOOLHOUSING NEEDS IN MINNESOTA

(Publication No. 10,048)

Roy Clifford Prentis, Ph. D.
University of Minnesota, 1954

As of May 1, 1953 there were 5441 administrative units in the State of Minnesota. Only 446 of these districts provided high schools as well as elementary schools, 3186 districts operated elementary schools only, and 1812 operated no schools whatever.

The major problem of this study was to show the relationship between district reorganization and the provision of adequate plant facilities. While the basic purpose was to determine the relationship between the nature of the district organization and the ability of localities to meet school building needs, the principles of adequate district organization were based on the total educational program rather than on purely financial considerations.

Criteria of adequate school district organization were developed from the literature and presented to a group of experts. The combined results of the findings in the literature, plus the reactions of these experts, indicated that two general principles should characterize school district organization. They are:

I. The local school administrative unit should be sufficiently large to maintain, with reasonable economy, an adequate program of elementary and secondary education.

II. The school administrative unit should be such as to contribute to the development of community values in the broadest sense.

It was further found, through the same general procedure, that in applying principle I each district should include a sufficient number of pupils for at least one satisfactory high school. Current opinion based on the literature and the judgment of specialists suggests that the desirable enrollment of a high school should be at least 600 pupils and that the minimum should be 300 pupils.

The study of the program of school district reorganization in Minnesota in the period from July 1, 1947 to December 31, 1952 showed that not a great deal was accomplished from the standpoint of securing adequate districts in terms of the above criteria. Although the total number of districts declined by approximately 2300 in this period, only 13 of the resulting districts could be considered as satisfactory.

A plan of districting which called for 257 districts in the entire state was proposed. Total school building needs for all districts under this plan would require approximately 365 million dollars by the fall of 1959. This figure was some 43 million dollars less than a similar total found by the Minnesota School Facilities Survey in which the assumed district plan was based on the 446 existing high school attendance areas. Furthermore a much higher percentage of the districts under the proposed plan of district organization would find it financially possible to meet their needs than the districts as presently organized or under the high school area plan of district organization.

On the basis of the findings of this study nine recommendations were set forth:

1. The program of school district enlargement in Minnesota should be continued.

2. A new concept of district organization needs to be developed for Minnesota.

3. A plan of administration unit organization should be based on broad principles.

4. Minnesota should adopt a system of intermediate administrative units as a necessary complement to a plan of basic administration units.

5. Comprehensive studies of area and regional districting problems should be encouraged and supported by the state.

6. The legislature should act to encourage adequate district organization.

7. The State Department of Education should be granted additional duties and responsibilities in matters relating to administrative unit organization.

8. State aid should be made available for school building construction.

9. State aid for school building construction should not be initiated until district organization is on a defensible basis. 357 pages. \$4.46. MicA54-2945

THE ROLE OF THE UNIVERSITY AND RECENT TRENDS IN THE CONDUCT OF SCHOOL SURVEYS

(Publication No. 9699)

Rex Klein Reckewey, Ph. D.
University of Nebraska, 1954

Adviser: Merle A. Stoneman

The purpose of this study was to discover the role of the university and recent trends in the conduct of school surveys. It included first, a thorough examination of the literature (1) to secure a summary picture of the evolution of the school survey movement as the necessary background for the remainder of the study, (2) to identify the various kinds of surveys which have been and are being conducted, and (3) to develop an understanding of the special contributions which various individuals, groups, and agencies can make to the school survey.

The second aspect of this study was the visitation

of seven selected universities which offer survey services. The survey director and key survey personnel at each of these institutions were interviewed concerning the organization, purposes, philosophy, and procedures of their respective survey programs. Thus, a comprehensive picture was acquired of the school survey services presently provided by the selected universities.

A third part of this investigation involved a follow-up study of the surveys conducted by the seven selected universities. By means of a questionnaire sent to seventy local schools, a report of current survey practices was obtained from administrators in the field. This report was used to ascertain the present status of the university survey services, to describe current practices, and to discover the reaction of the local school administrators to the university survey programs.

The following statements summarize the findings of this study:

1. Authorities are agreed that the school survey has contributed much to educational progress in the past fifty years.
2. There has been a steady increase in the demand for school survey services since the conclusion of World War II which has caused many universities to expand and reorganize their survey programs.
3. Most university survey programs are supported by a combination of (1) fees charged the local schools for services, and (2) funds appropriated from the university budget. There is a trend to make university survey services more nearly self-supporting by charging the local schools for the entire cost of the survey.
4. Although an increasing number of school survey authorities are advocating greater use of lay citizens in the conduct of school surveys, 45 per cent of the surveys reported included no use of lay citizens; and two-thirds of the surveys were characterized as "expert-type," while only one-third were categorized as "citizens" surveys.
5. A majority of all school surveys deal with special problems, and only a limited number are truly comprehensive in scope. School building problems are involved in almost two-thirds of all surveys.
6. Most universities described their survey programs as serving the three functions of service, training, and research in that order. While there is considerable evidence that most institutions are fulfilling the service function, there is much less evidence that they are achieving their stated training and research objectives.
7. Close working relationships between university survey specialists and state department personnel were not evident in a majority of the surveys reported.
8. Most universities view the drawing of conclusions and the making of recommendations as the responsibility of the survey experts.
9. Personal visits, classroom visitations, and examination of existing records are the techniques most widely used in gathering survey data.
10. A large majority of the local school

administrators view the university as the most logical agency to provide survey services.

11. Although most administrators were well satisfied with the survey services, the most frequent suggestions for improvement were (1) expansion of the service, (2) a greater variety of service, and (3) more lay citizen and school staff participation.

12. There is little evidence of the universities making follow-up studies to discover the effectiveness of their surveys.

548 pages. \$6.85. MicA54-2946

**THE SCHOOL SUPERINTENDENT'S JOB:
A STUDY OF HIS FUNCTION AND STATUS
IN THE PUBLIC SCHOOLS LOCATED
WITHIN A ONE-HUNDRED MILE RADIUS
OF HOUSTON, TEXAS**

(Publication No. 9849)

Lester Scott Richardson, Jr., Ed. D.
University of Houston, 1954

Problem. This study was made to determine the relationship of the sizes and wealth of schools and the job of the school superintendent and to determine his status in the schools located within a one-hundred mile radius of Houston, Texas. Specific hypotheses investigated are as follows: The sizes and wealth of schools are related to superintendent's jobs. The sizes and wealth of schools are related to the use of new administrative practices. The sizes and wealth of schools are related to the extent of delegation of responsibilities. The status of the superintendents employed in the defined region was also investigated.

Procedures. Over seven hundred selected administrative practices were listed in a questionnaire along with certain factors concerning the status of superintendents. These practices were classified under functions of the superintendents, such as the superintendent's relationship with the school board, relationship with the staff, relationship with the student body, relationship with the public and the superintendent's role in curriculum planning and supervision of instruction. The frequencies of the superintendents' use of the selected practices were correlated with school sizes and with school wealth. The status of the superintendent was compared with school size.

Findings. It was found that the superintendent of the larger school enjoys a better relationship with his school board but he does not enjoy the close relationship that the superintendent of the smaller school does with the student body and the public. However, the superintendent of the larger school is relieved of more of the details of the planning and business management of schools since he is able to delegate them to one or more of several administrative subordinates. He is also likely to make more use of newly developed administrative practices than does his colleague in the smaller school. The findings also indicate that the chances are that wealth of schools has little apparent effect on superintendents' jobs except

in the delegation of responsibilities. For the school superintendents studied in this investigation the following conclusions concerning their status seem to be warranted. The larger the school the more likely was the superintendent to have advanced to his position from a high school principalship. The mean age of all superintendents, considered together, at the time of election to their first superintendencies was 32.2 years and their mean age in their present superintendencies was 46.2 years. The larger the school the more likely is the chance that they have a greater number of years of administrative experience than do superintendents of smaller schools. Approximately one-third of the superintendents moved up from other positions in the school system to their present positions, 86 per cent received direct invitations from the school boards to apply for the positions, and slightly over 20 per cent heard about the vacancies, submitted applications, and were afterwards employed. Superintendents of larger schools tend to have a longer length of time remaining on their present contracts. Eighty-five per cent of the superintendents have written contracts. Most superintendents who change to other schools move because of better salaries, but one-half of the superintendents are in their first superintendencies. Some scientific validity can be given to the assumption that small schools are the training grounds for superintendents. Graduate study is confined almost wholly to the field of education and nearly all superintendents have done some study for degree credit within the last five years. Over half of them have completed at least one non-degree credit course within the same period of time. Forty-one per cent of the superintendents intend to study for doctors' degrees in the future, and 37 per cent have already made some progress toward that goal. Nearly one-third of the superintendents are furnished with a school-owned automobile for use in school business, and are reimbursed in most cases for use of their own automobiles for school business on a mileage or actual expense basis. Superintendents of large schools belong to and participate in more civic and professional organizations than do superintendents of small schools. Median salaries in Type A schools (499 or less pupils) was \$6,035, \$6,690 in Type B schools (500-999 pupils), \$8,040 in Type C schools (1,000-2,499 pupils), and \$10,750 in Type D schools (2,500 or more pupils). There was no significant difference in the tenure of superintendents in small and large schools. Nearly one-half of the superintendents who resigned or were dismissed in the years 1944-1954 left the profession.

Implications. If conclusions of this study are true then it follows that administrative training centers should make prospective superintendents aware that satisfying careers are to be found in the smaller and the less wealthy schools, that the heads of small schools generally become superintendents of larger schools, that there are good salaries in school administration, and that the presence or lack of school wealth has little effect on superintendents' activities except in the delegation of responsibilities.

277 pages. \$3.46. MicA54-2947

QUALITY OF EDUCATION RELATED TO
CERTAIN SOCIAL AND ADMINISTRATIVE
CHARACTERISTICS OF WELL-FINANCED
RURAL SCHOOL DISTRICTS: A STUDY OF THE
CENTRAL SCHOOLS OF NEW YORK STATE

(Publication No. 10,186)

Stanley Vernon Smith, Ph. D.
Columbia University, 1954

This research in the field of educational administration has examined the relationships among quality of education and five of its conditioners in the relatively well financed Central Schools of New York State, and it has identified areas where special attention could be expected to bring considerable returns in the improvement of the quality of education in these schools.

Determinations were made concerning the measure of school size, the weighting of the scores of Reminders for Observers, the school year to be used in calculating expenditure per pupil, the types of communities and the individual schools in each type, and the areas in the State, before these relationships could be investigated. Since this study involves approximately ninety percent of the total number of Central Schools, descriptive statistics rather than inferential statistics have been used.

The variability of and relationships among quality, expenditure, administration, and size of these schools have been investigated first for Central Schools in general, then for Central Schools grouped by type of community, area in the State, school size, expenditure per pupil, and quality of administration. The relationships between community type and area in the State also have been studied.

Some of the conclusions of this study are:

(1) Quality of education and quality of administration are normally distributed in the Central Schools studied. The distribution of expenditure per pupil, however, is peaked, and the distribution of school size is positively skewed. The narrow range of expenditure per pupil reflects the significant proportion of fiscal support these schools receive from outside the local community. The effects of centralization upon school size are shown in the positive skewness of the distribution of average daily attendance.

(2) The expenditure-quality relationship for these schools is strong, positive, and shows evidence of a plateau between 1946-47 expenditures of \$140 to \$149 per weighted elementary pupil unit. There is no tapering-off on returns for money spent in the Central Schools of highest expenditure.

(3) There is a high, positive administration-quality relationship, with evidence of a plateau for the second-highest administration group of schools.

(4) The size-quality relationship is strong, positive, and shows evidence of a plateau from approximately 500 to 700 pupils in average daily attendance.

(5) The relationship between school size and quality of administration is positive and strong, with evidence of an extended plateau for the schools of average size.

(6) The relationship between expenditure per pupil and quality of administration is positive and marked.

(7) The slight positive relationship between school size and expenditure per pupil becomes negligible when quality of administration is considered.

(8) The resort and industrial communities have an expenditure level substantially higher than the other types of Central School communities.

(9) School size is highly related to community type.

(10) Community type, quality of education, expenditure per pupil, quality of administration, and school size vary within and among the five areas in the State.

It seems reasonable to assume from the findings of this study that:

(1) Rural schools should be as large as possible, all other factors being considered.

(2) Expenditures per pupil for all rural schools should be raised by means of increased financial assistance from outside the local community.

(3) Improving the quality of administration could be of considerable value for all rural schools.

In conclusion, it may be deduced that there are many avenues which Central Schools, and all rural schools, may use to improve the quality of their educational programs. This study would indicate that the greatest improvements should evolve through cooperative study among rural schools of similar characteristics. 240 pages. \$3.00. MicA54-2948

MEASUREMENT OF SELECTED FACTORS AFFECTING CHANGE IN SCHOOL DISTRICT STRUCTURE

(Publication No. 9153)

James Edgar Stone, Ed. D.
University of Illinois, 1954

The specific purposes of this study are (a) to identify and select for measurement certain factors affecting the progress of school district reorganization, (b) to devise a method of measuring the relative strength of those selected factors, (c) to employ the method developed in measuring the potency of the selected factors in affecting district reorganization in Illinois, (d) to present the results of this measurement and to provide empirical tests of certain hypotheses concerning the reliability of measurement, the significance of the differences between the total strength of affective forces, and/or the strength of specific forces in reorganized counties, and the total strength of affective forces and/or the strength of specific forces in unreorganized counties, and (e) to provide empirical tests of hypotheses concerning differences of degree and type of purposeful activity by local leaders from the two types of counties.

An interview form was developed with which to secure the perceptions of leaders as to the strength of nineteen inhibiting and twenty motivating factors. These factors represent the results of examining the

literature in the area of school district reorganization and consultation with leaders in that movement. A total of 121 leaders were interviewed. For purposes of certain comparisons these were divided into three groups, namely, 13 persons with statewide influence, 54 persons who had been active in counties which were extensively reorganized, and 54 persons who were active in counties where virtually no reorganization occurred. An analysis of variance by ranks design (X_r^2), the rank correlation coefficient (τ), the critical ratio (t), and a two by three contingency table with Chi-Square (X^2) were chosen as appropriate for providing tests of hypotheses relative to reliability of measurement and the significance of differences.

The results indicate that a reliable measure of the relative strength of the affective factors was secured. Both sets of factors were ranked according to their degrees of potency as perceived by local leaders. The strength of the total inhibitory force and specific components of that force were perceived as being about equal by leaders from both types of counties, but the strength of the total motivating force and six specific motivating factors were perceived as being significantly stronger by leaders in those counties which were extensively reorganized. In general, the six specific motivating forces can be characterized as desires on the part of the people to improve the educational program by virtue of reorganized districts. The counties in which these desires were perceived as being significantly stronger are the same counties in which local leaders were significantly more active in three important areas of purposeful activity. Local leaders from reorganized counties were more active in developing the interest of key people, organizations or groups, and the general public. Thus the actions of leaders appear to be important forces in shaping the cultural attitudes of the people with respect to this change in administrative organization. 158 pages. \$1.98. MicA54-2949

AN ANALYSIS OF THE METHODS OF OPERATION OF PRINCIPALS TO DETERMINE WORKING PATTERNS

(Publication No. 9565)

Elbert William Van Aken, Ed. D.
University of Florida, 1954

This study is a part of the second phase of the W. K. Kellogg Foundation-University of Florida Leadership Project.

The purposes of this study were three-fold. First, to describe the behavior of selected school principals in key situations as they were reported by the principals and five teachers in each school. Second, to try to find patterns in these behavior descriptions. Third, if the patterns were discovered, to categorize the principals into a small number of groups for use in future phases of the Leadership Study.

The school district selected for this phase of the

Leadership Study was the Hillsborough County school system in Florida. The county selected had to have a sufficient number of principals necessary for the study, all types of schools had to be represented, there had to be a diversity of conditions and populations, and there had to be both rural and urban schools. The Hillsborough County school district met these requirements. Seventy-five schools were included in the study.

The instruments used in this study were:

1. The F Scale. A scale developed by Adorno and others to measure one's tendency toward authoritarianism.

2. The Guilford-Martin Inventory Factors GMIN. This instrument identifies five different personality variables, and the test was so devised that a measurement of each of the five traits could be obtained.

3. The Principal Behavior Check List. This instrument, developed by Alpren in the first phase of the Leadership Study, is a long instrument with eighty-six key situations (problems often encountered by a school principal) with from five to fifteen responses (ways the principal might handle the key situation) for each key situation. This instrument was administered to the principal and five teachers in each school.

During the course of the study four instruments were developed for the purpose of interpreting and classifying data. These instruments were:

1. The Principal Correspondence Scores. Using the principal's responses on the Principal Behavior Check List this instrument was developed to measure the degree to which one principal worked like other principals.

2. The Florida-Kellogg Authoritarian Scale. This scale was developed by a jury of three University of Florida College of Education professors who classified the authoritarian responses on the Principal Behavior Check List.

3. The Florida-Kellogg Democratic Scale. The same as (2) above except that the democratic responses were classified.

4. The Jury Correspondence Best Practice Scale. An instrument developed by a jury of professors with administrative experience. They selected the two "best practices" from the responses to each key situation on the Principal Behavior Check List.

Using the F Scale, the Guilford-Martin Inventory Factors GMIN, and the Principal Correspondence Scores many attempts were made to discover patterns of behavior, but all attempts ended in failure.

Reliable behavior patterns were discovered when the Florida-Kellogg Authoritarian Scale and the Florida-Kellogg Democratic Scale were used. Those principals placing high on the Florida-Kellogg Authoritarian Scale formed one group with a definite pattern of behavior. Those placing high on the Florida-Kellogg Democratic Scale formed another group with a definite pattern of behavior. Either or both of these scales gave criteria for isolating groups like each other and different from others in their behavior.

The Jury Correspondence Best Practice Scale had a very significant negative correlation with the Florida-Kellogg Authoritarian Scale and a very significant

positive correlation with the Florida-Kellogg Democratic Scale. This indicated a close relationship between the three instruments.

In addition to the discovery of behavior patterns of school principals one of the most important results of this study was the indication that a principal's personality characteristics, as measured by the instrument used in this study, had little relationship with his pattern of behavior.

208 pages. \$2.60. MicA54-2950

THE RESPONSIBILITY OF THE ASSISTANT SUPERINTENDENT OR OTHER EXECUTIVE FOR INSTRUCTIONAL SUPERVISION AND CURRICULUM DEVELOPMENT

(Publication No. 9702)

James Keith Varney, Ph. D.
University of Nebraska, 1954

The purpose of the present study was to determine the status of and the trends in the administration of instructional supervision and curriculum development in city school systems. In the present study a city was defined as an urban area, having within its corporation limits 100,000 or more people. The study was directed toward the study of the major aspects of instruction for which responsibility for execution must be determined.

Procedures designed to reveal the status of and the trends in the administrative organization for instructional supervision and curriculum development were: (1) review of the literature; (2) development of a questionnaire; (3) evaluation of the questionnaire by one administrative officer from each of five city school systems; (4) revision of questionnaire to embody appropriate suggestions received; (5) revised questionnaire was sent to 106 school systems in cities as defined above; (6) data received were analyzed and interpreted to obtain a comprehensive picture of the organization used in the administration of supervision and curriculum development in city school systems.

The first of the three divisions of the questionnaire was concerned with the organization and administration of the school system. This section was concerned with elements within the administrative organization of the school system affecting either the development or implementation of the instructional program. The data disclosed were as follows: all the functions of the school in many city school systems were unified and placed under the direction of one person, a superintendent of schools; many persons were directly responsible and reported to the superintendent. Seventy major administrative functions or combinations, for which an official was employed, were listed. Staff members in over one-half of the school systems acted as members of advisory councils and advised the superintendent; and in a majority of the city schools reporting a statement of school policies was used which outlined the duties of the administrative assistants.

The second part of the questionnaire dealt with the organization and administration of the instructional program within the city school system. The following data were secured: slightly over one-half of the city schools had one person responsible to the superintendent for the administration of all phases of the instructional program; eighteen different titles identifying the person in charge of the instructional program were received; the length of time during which one administrative assistant had had charge of all phases of the instructional program varied from six months to ten or more years; the superintendent usually delegated responsibilities for instruction to the person or persons then allowed considerable freedom to execute these responsibilities; there was a definite line of authority from the superintendent through the person or persons in charge of the instructional program to other school employees; the person in charge of instruction was usually allowed freedom to select his subordinates.

The third part of the questionnaire was concerned with the duties assigned to members of administrative staff. The superintendent was indicated as the person responsible for coordinating all educational activities and as the person who officially represented and spoke for the school system. The assistant superintendent in charge of instruction was usually responsible for coordinating the program at all levels. He coordinated the activities of people who developed the program and encouraged and guided, either directly or indirectly, the people who implemented the program. Other administrative assistants shared the work of the person in charge of the instructional program.

The present study revealed a definite trend toward unification of the creative and operative aspects of the instructional program under one person. This executive commonly bore the title the assistant superintendent in charge of instruction and was second in importance to the superintendent in the school system.

233 pages. \$2.91. MicA54-2951

IDENTIFICATION AND EVALUATION OF POST-HIGH SCHOOL EDUCATIONAL ACTIVITIES OF THE CLASS OF 1950 IN SELECTED NEBRASKA COMMUNITIES

(Publication No. 9703)

Andrew Anthony Weresh, Ph. D.
University of Nebraska, 1954

Adviser: Dr. Knute O. Broady

The purpose of this study was to identify and evaluate the post-high school educational activities of graduates of the Class of 1950.

Graduates of seven high schools from communities in which different types of collegiate institutions were located were used, as well as graduates of seven high schools from communities in which no such institutions were located. Each school was

visited to obtain intelligence quotients, rank in class, and address of the graduates of 1950. Questionnaires were sent to 1622 graduates whose addresses were found. Replies were received from 53.4 per cent or 49.8 per cent of the total number of graduates. Information from the questionnaire was tabulated under the headings: (1) present residence, (2) marital status, (3) post-high school educational activities, (4) employment record, (5) opinions of graduates pertaining to value of high school training, and (6) community activities.

The main findings of the study are as follows. More than half of the females remained in the communities in which they were graduated from high school. Almost eighty per cent of these came from the upper half of their class. Twice as many females as males remained in the community in which they were graduated. This is due largely to the fact that one half of the males were in the Armed Forces. The larger percentage of these were from the lower ranking half of their class. Thirteen per cent of the graduates were residing in other states and these were of high average mental ability. Larger communities retained a greater proportion of their high school graduates than did smaller communities. Thirty-one and two-tenths per cent of the graduates had married, twice as many of them females as males. The larger percentage of married graduates were from the lower ranking half of their graduating class.

Of the graduates, 57.6 per cent had engaged in some form of educational activity since leaving high school, with 37.7 per cent reporting college or university attendance. More males than females indicated post-high school training. Colleges and universities attracted the larger proportion of mentally capable graduates. However, of the 42.4 per cent indicating no post-high school training more than a third of the males and more than half of the females were from the upper ranking half of their class. Of the college-attending graduates, 83.1 per cent attended Nebraska institutions. The percentage of graduates who attended college from communities in which institutions of higher learning were located was higher than the percentage of graduates from communities where no such institutions were located.

Three years after graduation 26.3 per cent of the males and 15.8 per cent of the females were in some school. Employed full time were 17.8 per cent of the males and 42.8 per cent of the females. Full time housewives constituted 32.7 per cent of the total number of females. One per cent of the males and 2.6 per cent of the females were in business for themselves. Seventy per cent of the graduates not in a school indicated that they received their first job through their own efforts. The largest occupational group reported was clerical and sales. The largest number were in wholesale-retail trades. No relationship was indicated between income and mental ability. There was a direct relationship between grade rank and job tenure.

A majority of the graduates indicated their high school training had provided a general background for their present occupation. More than one fourth stated the job information and assistance given by their high

school was of little or no help to them. Community activities reported by the graduates referred more frequently to religious activities than to anything else. 176 pages. \$2.20. MicA54-2952

**A STUDY OF THE COOPERATIVE WORK
EXPERIENCE PROGRAM IN THE
DETROIT PUBLIC HIGH SCHOOLS**

(Publication No. 10,059)

Charles Jordan Wolfe, Ed. D.
Wayne University, 1954

Cooperative work experience is a program in cooperative training jointly planned, coordinated, and supervised by school and business with participating students attending school part-time and working part-time for pay.

This study was undertaken to describe and evaluate the cooperative work experience program in Detroit public high schools.

Data were collected during the school year 1952-53 in all Detroit public high schools having cooperative training programs. Questionnaires were administered to students enrolled in these programs and their cumulative school records were searched for additional material. Six hundred and fifty-five matched sets of records and questionnaires were assembled representing eighty-eight per cent coverage of the city-wide cooperative training enrollment. Principals, counselors, supervisors, coordinators, employers, and parents were interviewed or contacted through questionnaires. Study of the accumulated data revealed the following findings:

1. Cooperative training in Detroit is organized by curriculums and schools and conducted in compliance with state requirements for reimbursement. Principals, counselors, and supervisors play vital roles in organization and administration of the program. Where other conditions are favorable, the quality of coordination chiefly determines program success. Essential coordinator qualities are teaching ability and field experience.

2. Girls enrolled in cooperative training outnumber boys four to three. The office training curriculum enrolls fifty-one per cent of the students; industrial training, thirty per cent; retailing, nineteen per cent. Average age of students is seventeen; two out of three are senior. Enrollment is voluntary; a majority enroll for only one year. Students rate above average in scholastic, clerical, and mechanical aptitudes. Hours of work average slightly more than eighty per month. Boys enrolled in industrial training receive the highest pay though there is considerable individual range in pay regardless of sex or curriculum. Students regret their inability to participate more fully in school activities.

3. Distribution of student jobs is in line with vocational objectives of the three curriculums offering cooperative training.

4. Ninety-two per cent of the students rate fair

to excellent in scholarship; one half of one per cent are grade failures. More students improve than drop in scholarship after enrolling in cooperative training.

5. Students rate satisfactory in citizenship, but are less outstanding than before taking cooperative training. Punctuality and attendance improve.

6. The withdrawal rate from school is only half that of the city-wide high school student body. Twelve per cent of the cooperative training students credit the program with postponing or avoiding termination of their high school careers short of graduation.

7. Cooperative training students maintain a balanced curriculum.

8. Generally satisfactory use of student earnings is noted. Seventy per cent of the students aid financially at home.

9. Students see three major advantages in cooperative training: money, experience, practice in human relations. Few students see disadvantages in the program. Disadvantages noted are: inability to participate in extra-curricular activities, greater difficulty in maintaining good scholarship, lack of leisure.

10. Employers favor the program and hope to continue participating.

11. Principals, counselors, parents express general satisfaction with the program.

Concluding Remarks

1. Cooperative training utilizes the vast laboratory represented by shop, store, or office which cannot be realistically duplicated in school.

2. Acceptance as an adult and the need to get along with others on the job are valuable and maturing experiences for high school students.

3. Cooperative training provides a gradual transition from childhood and school to the adult world of work.

4. Cooperative work experience provides a means of serving that group of students who must work while attending school.

5. Disadvantages and questionable practices exist in the program pointing up a need for continuous evaluation as a basis for efforts aimed at improvement and corrective action.

6. Cooperative work experience promotes mutually beneficial community relations.

295 pages. \$3.69. MicA54-2953

EDUCATION, ADULT

**A TECHNIQUE FOR EVALUATING FAMILY
LIFE AND MENTAL HEALTH FILMS**

(Publication No. 9953)

Thomas Millard Poffenberger, Ed. D.
Michigan State College, 1954

Statement of the Problem

The purpose of this project was to devise a technique which could be used to determine audience

reactions to family life and mental health films in terms of: (1) concept change, (2) misconceptions, (3) emotional disturbance, (4) help with problems, and (5) the relationship between certain background factors and the film's effect.

Methodology

The film Palmour Street was selected for investigation and a questionnaire was constructed to test for the above factors. The method used to test for concept change and misconceptions consisted of a series of multiple choice questions. One question was constructed to test for each scene. In order to construct the questions, every word in the film, including dialogue and narration, was recorded. The film was then divided into scenes based upon the latter transcription. Four professional people working with this film, then decided upon the concept which each scene attempted to convey. Multiple choice questions based upon the scenes were then constructed to test for acceptance of the concept or preference of a less sound concept, as expressed in one of the alternative foils to the question. The set of questions was administered to a sample of 442 individuals, consisting of adults attending a meeting to study family life and mental health, students in a college marriage and family relations course, and a workshop group of family life educators. The same set of multiple choice questions was given in a pre-film questionnaire and a post-film questionnaire. Changes in response were analyzed to give an indication of the effects of the various scenes shown in the film.

The method used to test for emotional disturbance and help with problems was a series of five comment questions concerning audience feeling about the film. These questions were included in the second part of the questionnaire after the film showing.

The method used to test for the relationship between background factors and the film's effect was to include questions pertaining to background on the pre-film questionnaire and to compare the response to these items with the response to the multiple choice questions.

Findings

Some of the multiple choice questions used in the study were effective in determining misconceptions caused by the film. Other questions indicated misconceptions but the questions were not found to be valid. Differences in reaction to the film were consistently indicated in relation to one background factor - the fact that the audience member had or did not have children. The reason that more background items were not found to be significantly related to response may or may not have been due to the failure of the test to measure these adequately.

The comment questions regarding scenes most disliked and factors in the film causing concern were found to be effective in giving insight into the effects of the film. Those questions which were posed to determine whether the film had helped audience members with problems were found to be of limited value.

It was concluded as a result of this study, that family life and mental health films can be evaluated with useful results, by the use of multiple choice questions which also allow for comments regarding the film. 176 pages. \$2.20. MicA54-2954

A SURVEY AND EVALUATION OF THE EMPLOYEE TRAINING PROGRAMS IN THE LAUNDRY AND DRY CLEANING INDUSTRIES IN INDIANA

(Publication No. 8938)

Earl Perrin Tregilgus, Ed. D.
Indiana University, 1954

Chairman: Melvin S. Lewis

Problem

The purpose of this study has been to determine the training practices and procedures of the laundry and dry cleaning industries in Indiana and to evaluate the effectiveness of the training programs that were found to be in operation.

Methodology and Procedure

This investigation was carried on in two parts; first, a preliminary survey to determine the status of employee training within the industries and second, an evaluation of the training programs reported to be functioning.

The preliminary investigation was conducted by questionnaires and personal interviews, of which 233 returns were analyzed. The second part of this investigation was an evaluation of the training programs reported in the returns of the preliminary questionnaires. An evaluation check list was submitted to each of the 250 persons participating in the training activities of the 130 establishments reporting a training program. A total of 144 usable replies was received from 91 of the 130 establishments addressed.

The evaluation questionnaire attempted to appraise the personal traits and qualities of the trainers, to evaluate the practices and procedures of the trainers, and to measure the effectiveness of the existent employee training programs as measured by the degree to which these training programs accomplish the objectives considered essential to an effective training program.

The list of personal traits and qualities of the trainers to be evaluated was derived from literature in the field of personnel training and a list of traits and qualities submitted by an advisory committee representing the industries. Similarly, the teaching tools used in training activities and the desirable objectives of a training program were also derived.

Findings and Conclusions

1. Most employees receive some training for the job they are to do.

2. The training of route salesmen is usually longer and more intensive than that of production workers.
3. The manager or owner is indicated most frequently as responsible for employee training.
4. Trainers use self-developed instructional materials and demonstrations in most teaching situations; visual aids are seldom used.
5. Most training takes place on the job and after assignment to the job.
6. Adequate and ample training tools and materials are reported as lacking, yet the available training tools are not fully used.
7. Production workers are in the greatest need of training; office and clerical workers are in the least need of training.
8. Little use is made of the services of Distributive Education personnel in the training of the industries' employees.
9. The rate of labor turnover is considered as too high to reflect a healthy condition within the industries.
10. Trainers, in general, seem to possess to a satisfactory degree most of the personal traits and qualities considered desirable in a good trainer.
11. The evidences of good teaching practices on the part of the trainers appear less frequently than the evidences of desirable personal traits and qualities.
12. Most of the objectives of the training programs are usually achieved, although with varying degrees of success.
13. In most instances the training programs seem to accomplish the results for which they were planned and organized.
14. Present training programs seem to meet the needs of the industries.
15. The training programs are considered to be worth their cost of operation.
16. The training programs need to be evaluated and modified to meet the changing needs of the industries.
17. The training programs could not be shortened or discontinued without ill effects.
18. More attention should be given to the "human engineering" aspects of training.
19. Trainers need more information and training in the skills and techniques of employee training.
20. Very few of the employees in the laundry and drycleaning industries are graduates of specialized training institutes sponsored by the industries.

279 pages. \$3.49. MicA54-2955

EDUCATION, HISTORY

THE RE-EDUCATION OF THE JAPANESE PEOPLE

(Publication No. 9847)

John Griffin Chapman, Ed. D.
University of Houston, 1954

Purpose of This Treatise. The major problem of this study was to discover and analyze the experiences and contacts of the Japanese people relative to education; and, in the light of these findings, to draw conclusions to the following pertinent questions regarding the re-education of the Japanese during the American occupation in Japan:

1. What was the fundamental objective of the American occupation in Japan relative to the re-education of the Japanese people?
2. Is the new Japanese educational system, adopted during the American occupation, more democratic than the old educational system under the Japanese Empire?
3. Was the Oriental mind in Japan receptive to democratic ideologies?

This thesis was based on the premise that only through sound working knowledge and intelligent understanding of the Japanese educational systems – the old and the new – could it be determined if the new educational system is more democratic than the old.

1. What were the educational experiences of the Japanese people under the Japanese Empire?
2. What produced the old Japanese educational system?
3. How did it influence the old social order of Japan?
4. To what extent were the Japanese people re-educated during the American occupation?
5. What characterized the new Japanese education?
6. Why was re-education of the Japanese essential?

Sources of Data. The findings of this study have been thoroughly examined and critically assimilated over an extended period of time so that the conclusions set forth are the product of careful deliberation and thought. The general substance of the findings have been derived through the following media: first-hand experiences as political and social adviser on General Douglas MacArthur's staff in Tokyo for five years during American occupation, residence and study in Japan for fifteen years, teaching experience in Japan, personal interviews with Japanese leaders, investigation of literature on Japanese problems, and correspondence with Japanese officials.

Findings and Conclusions. This study revealed numerous findings relative to the re-education of the Japanese, the most significant of which are:

1. The fundamental objective of the American occupation in Japan was to achieve cultural and social changes through re-education of the Japanese people.

- a. The Americans laid the foundation of a new Japanese educational system, designed along modern democratic ideologies.
- b. The new Japanese educational system was founded on basic concepts of equality of opportunity, dignity of the individual, human rights, academic and religious freedom.
2. Education is more democratic in Japan today than it was during the Empire Era.
 - a. Education in old Japan was centralized in the National Cabinet and was controlled by chauvinistic despots or bureaucrats. It stressed ultranationalism, extreme militarism, eulogy of war, State Shintoism, and the divinity of the Emperor; thereby, disregarded human rights, exalted absolutism, sacrificed the individual for national glory, and made conformity a virtue. The old Japanese educational system was autocratic, discriminatory, rigid, impersonal; furthermore, designed to produce a subservient population of fanatics eager to give their lives to accomplish Japan's "divine mission."
 - b. Education in new Japan is controlled by the people through democratic processes. It provides functional curricula; thereby, stresses coeducation, equality of opportunity, human rights, constructive guidance, responsibilities of citizenship, and modern democratic theories.
3. The Oriental mind in Japan was receptive to democratic concepts of education and to ideologies of Western civilization. The Oriental mind was not impregnable; therefore, the Japanese could be won by understanding educators.
4. The American occupation forces not only succeeded in re-educating the Japanese youth, but they redirected the thought and energy of all the people toward the building of a more democratic way of life than the Japanese had ever known in the past; thereby, converting a nation of enemies into a nation of friends.

288 pages. \$3.60. MicA54-2956

THE DEVELOPMENT OF WOMEN'S HIGHER EDUCATION IN INDIA

(Publication No. 10,184)

Sripati Shridevi, Ph. D.
Columbia University, 1954

From prehistoric Vedic times to the present day, Indian society underwent tremendous changes due to three major upheavals affecting the status of women: Buddhism in the beginning of the sixth century B.C.; Moghul invasions in the eleventh and succeeding centuries; and the British conquest in the eighteenth century.

In Vedic times, one gathers from Sanskrit Literature, women were held in high esteem. They had freedom and equality of rights and opportunities with men. As a result there were highly educated women

to whom some of the Vedic hymns are attributed. Buddhism with its monastic ideals looked down upon women. Muslim invasions introduced Purdah, the seclusion of women, which affected adversely their position. The advent of the British indirectly opened a new vista before the women of India. Indirectly, because the British Government and its imperialism that opened the way for the rigorous proselytizing policy of the early Christian missionaries were deeply resented by the Hindus, whose defence of Hinduism and Hindu society resulted in the Indian renaissance and reformation in the second half of the nineteenth century.

The religio-social movements founded by Indian reformers swayed the entire subcontinent of India with new and powerful ideas that stimulated a favourable change in the status of women and kindled the spirit of nationalism in the people. These movements were unified under the name of the Indian National Congress and continued to work with greater force and effectiveness under the leadership of Mahatma Gandhi. His call to women to participate in the political mass movements brought a great many women out of their seclusion. Age old customs like child marriage, enforced widowhood, and seclusion of women were given up by many. The feminist movement also advanced the cause of women, with the result that women began to go freely to schools and colleges.

Along with the nationalist movement, Christian missionaries from the West have been engaged in educational activities with the aim of Christianizing India. They were pioneers in every branch of girls' education in India. Today they have thirteen arts and science colleges for women: three Protestant, ten Catholic.

The Government women's colleges, nine in number, excluding the six women's colleges in the Princely States, are secular in character and are open to all students.

There is another group of women's colleges called private, twenty-four in all, representing various religious groups other than Christian: Hindu, twenty; Neo-Hindu, two; Muslim, two.

There has been an impressive development of professional education for women. There are nine teacher training institutions including five departments attached to arts and science colleges, three women's medical colleges, and two women's colleges for nursing. Women are admitted into men's colleges for other professional subjects.

All the sixty women's colleges, not including a number of colleges not affiliated with universities, are overcrowded with students. There are as many women studying co-educationally in men's colleges.

Fifty years ago women's education was not only scarcely thought of but those who favoured it were severely criticized.

Today the interest of people in women's education is widespread and problems such as a special curriculum and extra-curricular activities for girls are engaging attention. There are a number of social and economic problems to be faced as a result of the development of women's higher education. But the need

for educated women in India is so great that these problems are not considered serious. Now that India is a free country with a democratic government the future appears bright for higher education of Indian women. 407 pages. \$5.09. MicA54-2957

(Note: This dissertation was completed and approved in 1949. The number of affiliated colleges for women has increased materially since then.)

EDUCATION, PHYSICAL

THE EFFECTS OF PRESENT METHODS OF TEACHING ON ATTITUDES OF MEN STUDENTS AT SOUTHWEST TEXAS STATE TEACHERS COLLEGE TOWARD RECREATIONAL PHYSICAL ACTIVITY

(Publication No. 10,029)

Martin Oliver Juel, Jr., Ph. D.
University of Minnesota, 1954

Introduction

This investigation has two purposes: first, the construction of an instrument to measure attitude toward any recreational physical activity without reverting to the laborious procedures of establishing the instrument's reliability and validity for each activity, and, second, the application of two equivalent forms of the instrument to groups of students taught by different methods of teaching to ascertain the effects of these methods upon the attitudes reported by these students.

The Construction of the Attitude Inventory

In the construction of the instrument, the Remmers modification of the Thurstone technique of scale construction was used. Statements indicating attitudes toward any recreational physical activity were collected and they were evaluated by five competent judges on the basis of established criteria. The statements which remained after this evaluation were then sorted into piles by students according to their degree of favorableness or unfavorableness. From these sortings, a scale value, the median score, and the Q value, a measure of ambiguity, were calculated for each statement. From these calculations, forty statements were selected for each of two forms of the Inventory.

Acceptable reliabilities were found for the scale values for each form. The equivalence of the two forms was established for each of two activities, swimming and tennis. Practice effects were minimized by administering Form A of the Inventory to one-half of each of the classes used, followed by Form B, and reversing the procedure for the other one-half of each class. Differences between the means of the two forms were insignificant at better than the .05 level of confidence for swimming and the .10 level for tennis.

Good correlations, .78 and .81, between Form A and B for tennis and swimming respectively were found, and the difference between these correlations was found to be insignificant. This served to establish the equivalence by comparing the scores made by students on the Inventory with the ratings of their attitudes by their instructors. An acceptable correlation, .68, was found.

The Application of the Attitude Inventory

Form A of the Inventory was then administered to each of six classes, followed by an instructional period of about five weeks, during which time the method of instruction used in the Division of Health and Physical Education at Southwest Texas State Teachers College, and two experimental methods, were employed in teaching swimming. Then Form B was administered and scored. A rating scale was also given to determine the influence of various items in the methodologies used upon the expressed attitudes of the students.

The six classes were equated at the conclusion of the experiment primarily on the basis of the mean scores made by each class on Form A of the Inventory. This equivalence was enhanced by similarities between the classes in physical fitness, experience in swimming, and environmental factors in the learning situation.

Conclusions

It was concluded that: (1) an attitude scale following the pattern set forth by Thurstone and modified by Remmers has been created. Whereas it is used in actual practice in this study only in swimming, it appears that it might also be used successfully with other recreational physical activities; (2) the three methods of teaching apparently had little effect upon attitudes of students; (3) there are some items more influential than others in affecting attitude changes. Items such as absences and make-ups, methods of motivation, amounts of explanation and demonstration, and methods of grading were among those most influential; and (4) there was slight evidence in favor of the most liberal method in producing the best results in changing attitudes, followed by the control method and then the "middle-of-the-road" method.

226 pages. \$2.83. MicA54-2958

EDUCATION, PSYCHOLOGY

AN INVESTIGATION OF THE RELATIONSHIP
BETWEEN ATTITUDES OF HIGH SCHOOL
STUDENTS TOWARD ETHICAL PRACTICES
AND SEVERAL ENVIRONMENTAL VARIABLES

(Publication No. 9853)

Eston Jackson Asher, Jr., Ph. D.
Purdue University, 1954

Major Professor: H. H. Remmers

The purpose of this study is to: (1) obtain a list of what high school students regard as the best and worst ethical practices in our culture, (2) have high school students express their attitudes toward these practices by ranking them in order of merit, and (3) determine to what extent these expressed attitudes are related to such environmental variables as sex, religion, grade in school, geographic region of residence, economic status, size of family, and church attendance.

In this study a preliminary sample of 900 high school students were used to obtain a list of the best and the worst ethical practices of people. These practices were included in Purdue Opinion Poll #38. This poll was administered to 10,000 students all over the nation. The analysis made in this study was based on a sample of 3,000 students selected from this group of 10,000 in such a way as to be as nearly representative of the nation's high school population as possible. These students were asked to rate the practices as to their relative merit. An average value for each practice was computed from these ratings. A list of the best practices of people, in order of bestness was thus obtained. A similar list of worst practices in order of worstness was also obtained.

The relation between these practices and the nine environmental variables was computed using chi square to determine whether or not the attitudes were differentially related to the various environmental variables. It was found from this comparison that there are a number of significant differences in attitude in each of the environmental categories. One hundred nine of the possible 252 chi square comparisons were found to be significant.

In so far as the attitudes measured and the subjects used in this study are concerned, the ethical attitudes of high school students are differentially related to the environmental variables. It was further found that certain attitudes toward ethical practices are less dependent upon the specific environmental variables than upon the general social conditions existing in our culture.

57 pages. \$1.00. MicA54-2959

THE RELATIONSHIP OF EMPATHY TO
SCHOLASTIC SUCCESS WITH IMPLICATIONS
FOR STUDENT PERSONNEL WORKERS

(Publication No. 9540)

Frank May Chambers, Ed. D.
University of Florida, 1954

It was the purpose of this study to investigate the relationship of empathy to scholastic success with implications for personnel work. Empathy is the psychological ability of an individual to put himself in the place of another and see the world as he does. Because it is the ultimate goal of personnel work for the individual to gain scholastic success, empathy as an aid to this goal should be studied, used and developed by the personnel worker.

Fifty-five male college students, with a common core of courses were given an empathy test. The empathy test scores were correlated with available intelligence and scholastic scores to determine their independent relationship to each other. The findings showed empathy and intelligence, as measured, are different abilities and that empathy is statistically related to scholastic success.

It was concluded that the most important use of empathic ability must be in the learning process and that this could be improved in the teacher-student relationship, thereby making every teacher a personnel worker. The use of empathy also has implications for the improvement of human relations between individuals, social groups, racial groups, and nations.

117 pages. \$1.46. MicA54-2960

CHANGES IN RESPONSES TO SELECTED
TYPICAL PERSONALITY QUESTIONNAIRE
ITEMS ADMINISTERED UNDER THREE
SETS OF DIRECTIONS

(Publication No. 8927)

Charles Edwin Fauset, Ed. D.
Indiana University, 1954

The Problem

It is rather well agreed that respondees of the conventional Yes-No type of personality inventories can change responses in desired directions when asked to do so. Also, it is rather well agreed that many respondees actually do respond in a manner which makes their personality picture more socially acceptable, especially when some desired goal is connected with their response, such as employment or acceptance into an institution for training.

Year after year thousands of high school students respond to some sort of paper-and-pencil personality questionnaire. Their purposes in answering would appear to spring from different sources. In general, they are not hoping for employment or for acceptance for training as they respond, and often they probably respond because the class has been asked to do so and not responding would lead to friction with the administrator.

The question raised for study concerned the extent of changes of response when high school students were presented a questionnaire on three different occasions with a different explanation of the use to which their responses would be put. Secondly, if significant changes of response occurred, the study was designed to determine what group of students made the changes. The hypothesis was that high school students would regard slight variations in the explanation of how the questionnaire responses would be used as sufficient stimuli to effect changes in response to the items on the questionnaire.

The Procedure

A questionnaire was constructed from the most frequently appearing items taken from six currently used personality inventories of the Yes-No type. Sixty items were used as typical questionnaire items. Three different explanations of purpose of the questionnaire were (1) that a purpose was to find out how high school students felt about certain things and that no names should be signed, (2) that a purpose was to obtain an answered questionnaire from each student to be filed in the office, and (3) that a purpose was to give teachers an immediate access to the responses made by the students. The questionnaire was then administered three times to 395 high school students from two high schools within a period of one week. The students participating were variously tested and found representative of their school population. A different explanation of purpose was given to six groups at each presentation, so that the order of presentation of different purposes could be rotated. In addition, two other groups responded three times under conventional and identical explanations each time. Information concerning age, sex, race, grade level, father's occupation, achievement, intelligence, and personality measurement was collected for each participating student. Response patterns during the three administrations of the questionnaire for each student and for each item were then recorded to provide the data for item analysis and student group analysis.

Findings and Conclusions

Over three-fourths of the students responded to the items in the same way during the three presentations. Some of the consistency appeared to be connected with the student's resistance to change after once responding in a certain way, however. The control group was significantly more consistent than the experimental, suggesting the desirability of unvarying administration of personality questionnaires and definitely guiding instructions to increase consistency. No difference in extent of changes was found between sexes or among students of different ages or grade levels. Significant differences were found, however, when students were grouped by race, achievement, intelligence, and score on a previous personality inventory. It was concluded that the response by an individual to an item on a personality inventory should not be taken as the final datum. A better solution

seemed to be to use the response as a source from which to study why the student responded as he did, rather than to classify the response in terms of a numerical score. 369 pages. \$4.61. MicA-2961

AN ANALYSIS OF EVALUATIVE STUDIES IN SELECTED AREAS OF GUIDANCE

(Publication No. 9710)

Joseph Warder Fordyce, Ed. D.
University of Florida, 1954

This study arose from a feeling on the part of the writer that, despite thirty or more years of growth and development, guidance services have not been accepted in the schools of the nation to the extent that might have been expected in light of the demonstrated needs of youth. To examine this belief, a questionnaire was sent to a group of randomly chosen school administrators, the results of which indicated that this group of educational workers considered guidance to be of great potential utility, but that they questioned the effectiveness in practice of guidance programs generally and of a number of specific services particularly. On the basis of the respondents' opinions, four areas of guidance in terms of outcomes that showed the greatest divergence between importance and effectiveness in practice were selected for further study. The assumption was that, if evidence of effectiveness in practice in these areas could be discovered and made available to groups of administrators and other educational workers, knowledge of such evidence might serve as a partial solution to the problem of fuller acceptance of guidance services as a means of meeting these important student needs.

The following four areas were chosen for further study: the improvement of curriculum; helping teachers understand pupils; the development of personal qualities; and the choice of occupations. The amount of evidence from research studies varies considerably among these areas, but it may be said generally that such evidence as does exist, and for some areas it is voluminous, the preponderance is favorable to guidance practices in respect to bringing about these desired results. Granted that this accumulation of positive evidence may stem partially from selective publication of favorable results, judgments must nevertheless be made on the basis of the available data. It would seem, therefore, that, on the basis of this mass of evidence, administrators and others charged with the determination of the programs of the schools could reasonably expand guidance and student personnel services in full confidence of good results provided only that adequate provision is made for the best practices now known to guidance workers.

This is not to suggest, however, that either guidance or the evaluation of guidance practices has achieved full fruition. The difficulties and pitfalls of evaluation studies have been examined at length, and an extended bibliography of research studies has been appended with the intention that such a

listing may be of assistance to workers intent upon more and better research.

It was noted, moreover, early in the discussion that neither guidance nor any other process would achieve acceptance merely on the basis of knowledge of the effectiveness of its results. There is a great difference between knowing and doing, and apparently many attitudinal, financial, and theoretical objections to the acceptance of guidance and guidance philosophy will continue to loom large in the minds of some educational workers and some segments of the society that supports the schools. The fact remains, however, that the evidence seems to support the belief that important needs of students have been met through guidance services. It is believed that these services must continue to be evaluated with full consideration given to the pitfalls of past research and to the positive approaches suggested in this and other studies. Only in this way can guidance reach full acceptance as a mature profession and continue to make the contribution to the society and to the individuals within the society of which it is potentially capable.

147 pages. \$1.84. MicA54-2962

DEVELOPMENT OF MICHIGAN COLLEGE COUNSELING PROGRAMS — 1940-1950

(Publication No. 10,055)

Stanford Howard Glazer, Ed. D.
Wayne University, 1954

This study has three main purposes: to record the development of Michigan college counseling programs during 1940-1950; to show similarities and differences within the development of the various programs; and to depict the problems and issues which state college counseling programs faced during the decade. Twenty-three Michigan colleges and universities are included in this investigation. The schools were selected because they met North Central Association accreditation standards and because they had sufficiently large veterans enrollment. They were divided into four groups: Junior Colleges, Publicly Supported Colleges and Universities, Colleges of Education, and Private Colleges.

The study is divided into three major periods: period one, 1940-1945, shows the development in Michigan college counseling programs during the defense and war years; period two, 1946-1948, has as its main emphasis the return of veterans and their impact on the state college counseling field; period three, 1949-1950, depicts the developments in college counseling which occur after the decline in veteran enrollment. National trends in counseling during 1940-1950 are presented as a background to the Michigan investigation.

The findings reveal that impending military service and the lure of lucrative industrial jobs were sources of problems created for college students during the war and defense years. Reduced student bodies, usually predominately female, caused problems for many of the Michigan colleges during this same

period. Counseling was called upon to assist in both of these problem areas. The appearance of "divisions" of student personnel services at several of the larger institutions of the state was a main characteristic of counseling growth during the years 1940-1945.

The return of the veteran, and the financial assistance given by the Federal Acts, are emphases of the second period. The counseling program cooperatively established by the Veterans Administration and the colleges and universities of the state, provided opportunity for expansion of counseling staffs and counseling facilities. Twelve schools included in this study operated Veterans guidance centers. Counselors, additionally, were appointed by individual colleges and universities in the state to assist veterans with special problems. Many of these problems pertained to veterans' rights under the Federal Acts. The growth of counseling as a profession, and a distinction between counseling and "advice-giving" functions were further important developments which occurred during this period.

Further expansion of student counseling services and planning for increased community counseling services were important developments which took place during the final period. Concern for improving counseling techniques, procedures and methodology was additional evidence that college counseling in the state was emerging as a profession during 1949-1950.

There were several similarities between the development of Junior College and small college counseling programs in the state. The counseling programs of these schools during the pre-war years were confined mainly to curriculum advising and disciplinary judgments. The beginning of specialized counseling services began to appear at the smaller institutions of the state during the post-war years. The large schools provided varied student personnel services during the entire period. Leadership in the development of student and community counseling services were characteristics of the counseling programs of the large publicly supported school in the state.

There were several major problems which college counseling in the state faced during the decade. Problems of restricted budget for counseling services; the problem of defining the role and scope of the counselor in the total educational program; the problem of the "specialist vs. the generalist" in counseling programs; the problems of improving relationships between counseling personnel and instructional faculty; and the problem of careful self-appraisal by counseling staffs were major issues faced by college counseling programs.

160 pages. \$2.00. MicA54-2963

**RELATIONSHIPS BETWEEN PERCEIVED
LEADERSHIP, PERCEPTIONS OF THE
IDEAL, AND GROUP PRODUCTIVITY IN
SMALL CLASSROOM GROUPS**

(Publication No. 9087)

Ruby Mae Holden, Ph. D.
University of Illinois, 1954

It was the purpose of this study to investigate relationships in a number of groups in order to check on the hypothesis that in small groups in a classroom situation, if the members perceive those who show high leadership as being close to their perceptions of the ideal, the group is relatively high in productivity. Ten small groups in two classes of college seniors in Educational Psychology were used in this study.

In reviewing the background of the problem, the definition and characteristics of the group, the justification for the use of the small group within the larger classroom situation, current methods for the study of small group processes, concepts of group leadership, various effects of interpersonal perception on group processes, and methods for evaluation of group productivity were considered.

Leadership was conceived as a dynamic relationship, changing within the group as various aspects of problems and sub-problems were defined and brought to conclusions in the process of completing the project as the group itself had defined it, analyzed it, and brought it to its final conclusion. The degree to which any member of the group was perceived by its members to have assumed the leadership role and performed its functions in a manner defined by specified criteria of good leadership determined the Leadership Score for any individual.

Perception of the ideal was considered in relationship to performance in small group work in a particular setting, the classroom. Each member of each group indicated his perception of the ideal by arranging 25 items of specific behavior and personality characteristics in rank order of their applicability to the ideal. For each individual in each group the measure of his perception of the ideal was compared with his perceptions of the other members of his group obtained with the same instrument. From these, the distances of each of the members of the group from the ideals of every other member of the group were obtained, and for each individual an Average Distance from the Ideal Score was calculated, which represented his average distance from the perceptions of the ideals of the members of his group.

Using the Leadership Scores and the Average Distance from the Ideal Scores, a correlation was obtained within each group between high leadership and the closeness to the ideals of the group members.

Group productivity was considered in this study to be the degree of success in the performance of the tasks of the group, which consisted of presentation in both oral and written forms of the results of group research, as measured against developed criteria for good products. Evaluation of productivity was cooperative, involving the members of the group, the rest of the class, and the instructor, both in the

establishing of criteria for evaluation and in judgment of the products in relation to these criteria. The Group Productivity Score, representing the degree of success of the group, was a compilation of the results of these judgments.

To show the degree to which high Group Productivity in a group corresponded to a high correlation between Leadership and Average Distance from the Ideal, a correlation was obtained between the Group Productivity Scores and the correlation coefficients which resulted from relating high leadership with closeness to the ideal, with a resulting correlation of .64. The results in general tend to support the hypothesis that if there is a high relationship between good leadership and closeness to the ideals of the group, the group is relatively high in productivity.

116 pages. \$1.45. MicA54-2964

**A STUDY OF THE EFFECTS OF TEACHER
KNOWLEDGE OF PUPIL CHARACTERISTICS
ON PUPIL ACHIEVEMENT AND ATTITUDES
TOWARDS CLASSWORK**

(Publication No. 9616)

Kenneth Boyd Hoyt, Ph. D.
University of Minnesota, 1954

The purpose of this investigation was to study the effects on pupil achievement and attitudes as a result of providing teachers with varying types and amounts of information about the pupils they teach. The three differentiating treatment variables were: (a) No systematic information about their pupils; (b) Results of standardized tests of intelligence and achievement taken by their pupils; and (c) Standardized test results plus information concerning personal characteristics of their pupils.

Populations Studied, Sampling Procedures, and Design

The experiment was conducted during the school year 1953-54 utilizing six sections of eighth grade pupils in two junior high schools. Two samples of 90 and 120 pupils were drawn from populations of 290 and 356 pupils respectively in these two schools. Complete analysis data were available for 85 students in one school and for 109 in the other.

Individual students in each school were selected for and assigned to experimental sections by the method of stratified random sampling from the two populations. The two bases used for stratification were sex and scholastic aptitude.

The statistical design employed in the study of pupil achievement was a 2 x 2 x 3 x 3 factorial with schools, sex, ability level, and treatments representing the factors involved. In studying pupil attitudes, a 2 x 3 x 3 x 3 factorial design was employed with sex, ability level, subject, and treatments representing the factors involved. Teacher knowledge of pupil characteristics was studied through a 3 x 3 factorial, with subject and treatments being the factors involved.

Pupil achievement scores were analyzed by means

of analysis of variance and covariance using the method of unweighted means with unequal frequencies in the subclasses. Pupil attitudes were analyzed by means of analysis of variance using the method of unweighted means with unequal frequencies in the subclasses while teacher knowledge was analyzed by means of analysis of variance using the least squares approach with equal frequencies in the subclasses.

Findings

No significant differences in pupil achievement were found in mathematics and social studies as a result of any of the three treatment variables, but significant differences in favor of providing teachers with no information was found for English achievement. The presence of significant interaction with the treatment effect clouded the meaning of this finding. Analysis of pupil attitude scores showed significant differences in favor of providing teachers with information concerning personal characteristics of students along with test scores in one school. In the other, trends favoring this treatment were evident, but statistically significant differences were not found. Providing teachers with systematic information about their pupils was found to increase significantly the amount of their knowledge of pupil characteristics and differences.

Summary Conclusions

Using the statistical analysis and statistical conclusions as a base, the following summary conclusions were drawn:

1. Teacher knowledge of pupil characteristics was increased through the use of appraisal data.
2. Teacher knowledge of pupil characteristics did not, by itself, result in increases in pupil achievement in mathematics, social studies, or English.
3. Teacher knowledge of pupil characteristics did not act preferentially on ability levels of pupils in terms of its effect on increases in pupil achievement in mathematics, social studies, or English.
4. Teacher knowledge of pupil characteristics did not act preferentially on either sex in terms of its effect on increases in pupil achievement in mathematics, social studies, or English.
5. The effect of teacher knowledge of pupil characteristics on pupil attitudes towards teachers was positive but not consistently significant.
6. Teacher knowledge of pupil characteristics did not act preferentially on ability levels of pupils in terms of its effect on pupil attitudes towards teachers.
7. Teacher knowledge of pupil characteristics did not act preferentially on either sex in terms of its effect on pupil attitudes towards teachers.

199 pages. \$2.49. MicA54-2965

SPECIFIC READING ABILITY AS ASSOCIATED WITH SUBJECT MATTER ACHIEVEMENT

(Publication No. 9694)

Jacob Robert Lebsack, Ph. D.
University of Nebraska, 1954

Adviser: Charles O. Neidt

The purpose of this study was to determine the relative effectiveness of specific reading tests and a general reading test in combination with an intelligence test for explaining individual differences in the achievement of high school juniors and seniors in specific subject matter areas. The subject matter areas selected for this investigation were social studies and natural sciences. The extent to which standardized reading tests based upon a specific subject matter area elicit different behavior from a student than is elicited by achievement tests involving the same area was determined by use of the F-Test for Departure From Homogeneity. Standardized tests of specific reading ability in a subject matter area and of achievement in the subject matter area were used in this investigation.

The two achievement tests used for this study were the social studies and natural science sections from the Harry-Durost Essential High School Content Battery. The two specific reading tests chosen were from the Iowa Tests of Educational Development, entitled, "Ability to Interpret Reading Material in the Social Studies," and "Ability to Interpret Reading Materials in the Natural Science." The Cooperative English, Reading Comprehension Test was chosen to measure general reading ability.

Subjects were 205 juniors and 190 seniors from two Nebraska high schools. The five tests were administered to the 395 students in their own schools during the spring semester of 1954. Intelligence test scores were the Terman-McNemar Test of Mental Ability, and the California Test of Mental Maturity used in the smaller school, and the Otis Quick Scoring Test of Mental Ability used in the larger school.

A test of homogeneity was applied to the achievement test and the specific reading test in each area. The two F-values resulting from the application of the F-Test were found to be significant beyond the 1% level, indicating that the reading test and the achievement test were non-homogeneous with regard to the behavior elicited from the student.

An analysis of multiple regression with three independent variables was made for each of the subject matter areas by class level. Using the achievement test scores as the criterion in each analysis, the three variable regression was computed using the corresponding reading test as the first variable, the general reading test as the second, and the intelligence test as the third.

The results of each of the four analyses of regression indicated that the elimination of the specific reading scores resulted in a highly significant loss.

When the influence of the general reading test was eliminated from the equations, the results were not uniform. The loss was significant for seniors in both

social studies and natural science, but was not significant for the social studies analysis for juniors and was significant at only the 5% level for the natural science analysis for juniors.

The elimination of the intelligence test scores from the regression equations revealed a similar non-uniform pattern. The elimination resulted in a significant loss when applied to the social studies and natural science scores for juniors, but was not significant when applied to either subject matter area for seniors. Further research seems desirable to determine the causes for this discrepancy.

It was concluded that specific reading ability does exist to a significant degree in explaining individual differences in the achievement of high school juniors and seniors in social studies and in natural science. Specific reading ability tests contribute to the explanation of individual differences in social studies and natural science achievement in this study to a greater degree than does the general reading ability test used in this study when juniors and seniors in high school are used as subjects.

105 pages. \$1.31. MicA54-2966

AN INVESTIGATION OF THE SCOPE OF MOOD RESPONSES OF INTERMEDIATE GRADE PUPILS

(Publication No. 7586)

Alfred Cornelius Moon, Jr., Ed. D.
University of Missouri, 1954

Major Adviser: Ralph K. Watkins

PURPOSE: The major objective of this investigation is to ascertain the scope of mood responses evoked from certain intermediate grade pupils. The instrument used to collect the data was a response schedule consisting of three parts: (1) the information schedule, (2) the descriptive terms used to define the eight mood categories, (3) the musical selections chosen to evoke specific mood responses. The musical selections were rated by the pooled judgments of a jury of music education specialists on their ability to communicate a specific mood. The descriptive phrases used to identify the mood categories were obtained from the responses of thirty intermediate grade children.

SUMMARY: More than one-half of the pupils were able to respond correctly to music representing eight mood categories. The percentages of correct responses to the mood categories were:

- Category II (sad, mournful, gloomy, melancholy) 75.0 per cent
- VII (restless, soaring, triumphant, dramatic) 67.9 per cent
- I (spiritual, solemn, serious, sacred) 53.9 per cent
- IV (serene, quiet, soothing, satisfying) 48.7 per cent
- III (dreamy, tender, loving, yearning) 44.1 per cent

- V (playful, delicate, light, graceful) 43.1 per cent
- VI (merry, gay, happy, cheerful) 38.3 per cent

When organized into related mood categories, the subjects were able to respond more accurately to four more broadly defined mood categories.

These factors were found to have little influence on the pupil's ability to respond to moods evoked by music:

- (1) maturity differences in grades five, six, and seven
- (2) superior ability as defined in this study
- (3) sex differences
- (4) additional time above 100 minutes of curricular music instruction
- (5) pupils preference for musical television programs

Certain factors were found to have definite influence on the pupil's ability to respond to moods evoked by music such as:

- (1) instrumental training
- (2) private music study

The factor that had a marked effect on the pupil's ability to respond to moods evoked by music was his preference for musical radio programs and the apparent results that accrue from musical listening experiences.

CONCLUSIONS:

- (1) It is possible to develop a response schedule which will record the mood responses evoked by selected musical items from intermediate grade pupils.
- (2) The musical selections that have the ability to evoke mood responses from intermediate grade pupils can be compositions rated by a jury of music education specialists as being effective in communicating a specific mood.
- (3) Children in intermediate grades can respond successfully to mood categories established for adults. The scores of correct responses showed over 50.0 per cent for the range of the eight distinguishable mood categories and as high as 75.0 for an individual category.
- (4) The factors of maturity, sex differences, and superior ability on the individual's ability to respond to moods evoked by music.
- (5) All in-school and out-of-school music experiences have positive influence on the ability of the individual to respond to music selected to evoke specific mood responses. Listed in order of primacy:
 - a. Pupils preference for musical radio programs
 - b. Private music study
 - c. Instrumental music training
 - d. Preference for musical television programs
 - e. Curricular music instruction of more than 100 minutes
- (6) The pupils were noticeably more able to respond correctly to four more broadly defined mood categories resulting from combining

closely related moods, the score going to 90.0 per cent on some groupings.
196 pages. \$2.45. MicA54-2967

SOME EFFECTS OF TASK INDUCED TENSION IN SCHOOL CHILDREN

(Publication No. 9887)

Robert F. Phelan, Ph. D.
Purdue University, 1954

Major Professor: N. C. Kephart

The purpose of the study was to test the hypothesis that restless movement is related to tension. During the course of the experiment an attempt was made to identify other behavioral correlates of tension. (Later developments indicated that changes in reading distance might be correlated with tension.) It was hoped that such measures might eventually be used as criteria for evaluating the effect of certain environmental variables on psychological adjustment in the school room.

Twenty fourth grade students from the Klondike grade school served as subjects for the study. They were given four three minute oral reading tasks of different levels of difficulty. The method used to gather the data was memomotion pictures. Restless movements and reading distances were measured by film analysis.

A later experimental session was conducted in which six subjects were retested. At this time, retinascopic readings were taken while the subjects were performing an oral reading task at a fixed distance.

A significant relationship was found between level of difficulty and number of restless movements. As level of difficulty increased there was a corresponding increase in the number of restless movements made by the subjects.

There was a significant relationship between level of difficulty and reading distance for the group classified as "more" restless. As level increased, reading distance decreased.

There was a significant relationship between reading time and reading distance. As time in the task increased, reading distance decreased. The results obtained during the second session suggested that decreases in reading distance were due to accommodative changes in the eye.

Those individuals who read "closer" to the material were found to be "more" restless than those who read "further" away.

It was tentatively concluded that restless movement and reading distance changes are behavioral correlates of tension.

72 pages. \$1.00. MicA54-2968

DIFFERENTIAL VALUE PATTERNS OF COLLEGE STUDENTS

(Publication No. 9698)

Wesley A. Poe, Ph. D.
University of Nebraska, 1954

Adviser: Warren R. Baller

The purpose of the present study was to determine if it is possible to differentiate between college students in different fields of concentration in terms of their patterns of personal values. This type of information is of significance for those who desire a better understanding of value patterns in educational and vocational guidance.

Since existing value instruments were not adequate for the design of the study, the development of a satisfactory instrument became an important phase of the research. Eight value areas were identified and included in the instrument. These areas were: Aesthetic, Material, Intellectual, Power, Social Contact, Religious, Prestige and Humanitarian. Items, requiring a response to be made on a five-point scale from strongly agree to strongly disagree, were constructed for measuring the behavior in the eight areas. An item analysis was made of the 200 items in the preliminary form of the inventory, using a cross-section of 349 upperclass college students. Flanagan's table was utilized in the selection of the 150 items for the final form.

A test of homogeneity was applied to the inventory to compare the relative homogeneity of items among or between areas with that found within the areas. When the 112 possible intercorrelations between the split-halves of the eight areas were computed, and each area was compared with every other area, the resulting F-values were highly significant. This is interpreted to mean that each of the eight areas was sufficiently non-homogeneous with respect to the other areas to warrant obtaining a separate score. Spearman-Brown reliability coefficients were found to range from .84 to .93 for the various areas of the final form.

The Inventory of Values was then administered to a sample of 60 senior men in Business Administration and to a sample of 60 senior men in Teachers College. Group means were computed, and the resulting data were subjected to analysis by means of the multiple discriminant function technique to determine if the value patterns differed significantly.

To obtain the needed values for the discriminant function, the raw scores were converted to deviation values. These were substituted into the eight discriminant equations to be solved by simultaneous solution. The difference (D) between the means of the two groups on the eight variable discriminant function was then tested for significance. The resulting F-value was highly significant, indicating that Teachers College men and Business Administration men can be differentiated significantly on the basis of their value patterns. Four areas, Material, Intellectual, Aesthetic and Humanitarian, contributed 91 per cent of the total discrimination between the groups.

Business Administration men were higher on Material values and the Teachers College men were higher on Intellectual, Aesthetic and Humanitarian values.

Correlation coefficients also were computed on a random sample of 27 subjects between the areas of the Inventory of Values, those of the Study of Values and six group scores on the Strong Vocational Interest Blank. In general, the results would indicate that several behavior characteristics are being measured by the Inventory of Values which are not represented in the other instruments.

In conclusion, the major finding of the investigation is that significant differences exist between the patterns of personal values of college seniors in different fields of concentration. Namely, Business Administration men and Teachers' College men were found to have significantly different patterns. This has implications for use in educational and vocational guidance. The evidence also suggests that the multiple discriminant function technique is a valuable tool for the analysis of group differences when patterns of values are studied. The Inventory of Values has promise of being a useful instrument in value research. 121 pages. \$1.51. MicA54-2969

A STUDY OF VISITING TEACHER CASES RECEIVING LENGTHY SERVICE

(Publication No. 10,058)

Sarah Gentry Terrill, Ed. D.
Wayne University, 1954

The purpose of this study is to point out that the prevailing philosophy in education, teaching the whole child, has resulted in a major adjunct to education which is described as School Social Work. This service was initiated as a result of the schools' growing awareness of its responsibility for meeting the needs of children who, because of emotional distress, are unable to profit by the established educational process. The implementation of a statewide program, its incorporation into a school which had an established guidance program, and the specific assignment of a state certified school social worker is described.

A study of the assignment on a pupil-worker ratio basis indicated that the worker's school population of 6,683 pupils, using the two per cent estimate of need as indicated by the state of Michigan, would have produced 133.76 cases for the school year 1952-1953, a case load that could not be handled properly if the use of professional skill and techniques are considered to be of paramount importance. The principals of the buildings servicing these 6,683 children estimated that, had adequate services been made available to them, 312 children, or four per cent, could have benefited by the school social worker's services.

The present screening process, which gives the principals the final decision in the choice of children to receive services, produced case loads that were

heavily weighted with seriously disturbed children. Their ultimate choice of children to receive service was in keeping with the hypothesis presented in this study:

1. The school should assume the responsibility for helping the child whose parent is unwilling or unable to seek help for him from an established treatment agency.
2. There is a current lack of facilities in the community for helping all these children whose needs become known to the school personnel and to the school social workers.

The second part of the study is a presentation of case material selected from the writer's case load and has to do with children who receive lengthy service because of their continuing need. Five types of behavioral patterns with symptomatic expressions are described. Three abstracted cases in each group are used as illustrative material. The cases presented in Chapter III, Children in Open Conflict, Chapter VI, Children Recommended for Treatment in a Mental Hospital, and Chapter VII, Children Diagnosed as Brain Injured, became time consuming cases and did not respond satisfactorily to School Social Work services. The types of cases presented in Chapter IV, Children with Generalized Anxieties, and Chapter V, Children with Converted Anxieties, while time consuming, do respond to school social work services if there is sufficient time for the worker to use the specific skills and techniques that are a required part of the worker's training and experiences.

The school social worker, with the present referral arrangement and the extensive school assignments, frequently finds she is held responsible for bringing about improvement in children who are in need of assistance from specialized agencies. In many cases these agencies are overcrowded or do not even exist for meeting the needs of these children. While all the children referred for school social work services are not as seriously disturbed as the cases presented in this study, there is an alarmingly large number of them.

The conclusions of this study indicate the need for the continuation of training programs and the requirement of state certification for school social workers. The responsibility rests upon the school administrators in a school system for adequately planning for the administration and, where the need is indicated, for the extension of the social work program. It is the writer's belief that this service is not a fad nor a frill in education but is an indication of an attempt, on the part of the community through its most influential institution, to increase and advance the mental health of our society. 418 pages. \$5.23. MicA54-2970

A TECHNIQUE FOR ASSESSING TEACHER HUMAN RELATIONS

(Publication No. 9721)

Ralph Harpham Walker, Ed. D.
University of Florida, 1954

This study was developed as one of the first year exploratory researches of the University of Florida Kellogg Leadership Study. The University study, launched in July, 1952, aims at testing the hypothesis: Leadership qualities of the school administrator significantly influence human relations, pupil achievement, program development, teacher activities, and school-community relationships of the school.

For the first phase of the Florida project a year-long intensive study of four selected pilot schools was proposed with the dual aim of building a detailed picture of the nature of reality in the four schools and of permitting the development and testing of methods and techniques which would be feasible for use in large scale testing in a number of schools in later phases of the project.

The present study focused on teacher human relations within the school and sought to develop techniques and instruments which could be administered by individuals with little training and which could be administered and scored with a minimum expenditure of time.

The researcher participated with the research team in the intensive study of the four schools from February until June of 1953. He visited in the schools, talked with principals and teachers, visited and observed classrooms, attended faculty and committee meetings, and participated in various other activities of the four schools.

At the same time he reviewed the literature for available tests in the area of human relations and related fields. Since none of the tests reviewed were entirely adequate to the purposes of the study, the writer selected the Guilford Martin Inventory of Factors GMIN as a standardized personality test; he developed a modified sociometric questionnaire and a general information sheet; and he designed an open-ended questionnaire and a Likert-type questionnaire. These latter two instruments explored how the teacher felt about six areas: (1) the profession, (2) other teachers, (3) the principal, (4) children, (5) the school, and (6) the community.

The instruments were administered to teachers in the four schools during the post-planning period in June of 1953. The Likert-type questionnaire was then shortened by the selection of items which displayed high item-test correlation coefficients and met other criteria which had been established for item selection. The response scale was changed from a five-point to a three-point scale. This modified instrument exhibited promise of validity and reliability on the basis of the internal statistical evidence developed in the study. As indicated by chi square eighty-eight of the one hundred twenty selected items displayed discrimination between schools significant at the five per cent level of confidence or beyond; t ratios indicated that the differences among

schools on mean section and mean total scores on the questionnaire were significant at the five per cent level or beyond in all but thirteen of the forty-two possible combinations; intercorrelations among the six sections of the test ranged from .354 to .791, suggesting that the sections were justified as separate scores while being sufficiently related to warrant their inclusion as parts of the total test. In addition, the odd-even correlation coefficient was .901, or .948 after correction by the Spearman-Brown prophecy formula.

The questionnaire correlated .520 with an instrument developed by Mathews to measure certain of the professional activities of teachers. Her instrument was developed and tested with a sample of fifty teachers from the same four schools during phase one of the Florida study.

The questionnaire exhibited a logical relationship to the responses of teachers to the open-ended questionnaire; responses to this latter instrument did not yield readily to quantification, however, and no attempt was made to examine the relationship statistically.

Finally, the questionnaire mean scores displayed a consistent positive relationship to the rating of the four schools assigned by this researcher on the basis of his intensive study of those schools.

The modified questionnaire, with the open-ended questionnaire as a possible supplementary device, was recommended to the research staff as the central instrument for use in studying human relations factors in the future phases of the University of Florida Leadership Study. 145 pages. \$1.81. MicA54-2971

EDUCATION, TEACHER TRAINING

A STUDY OF CERTAIN FACTORS INVOLVED IN THE EFFECTIVE UTILIZATION OF THE SERVICES OF EDUCATIONAL CONSULTANTS

(Publication No. 10,021)

Mary Riggan Downing, Ed. D.
University of Virginia, 1954

It was the purpose of this study to determine (1) what types of consultant help have been used in certain selected school divisions during the past three years; (2) to what extent consultants' ways of working with school personnel are believed to affect the success of the program; (3) to what extent certain personality factors on the part of consultants are believed to be conducive to the success of the undertaking; and (4) what types of consultant help are recommended for future use by supervisors, teachers, and consultants involved in this study.

The interview guide used was developed in accordance with suggestions made by fifteen supervisors and was approved by ten additional supervisors to whom it

was submitted for examination and criticism. The guide was then given to supervisors in 109 school divisions in the states of Virginia, Delaware, Maryland, North Carolina, and South Carolina. This guide was introduced also to three teachers in each of the ninety-seven school divisions from which supervisor responses had been received. Both teachers and supervisors were requested to respond to the same questions and to submit the names of two or three consultants (in each case) who, they considered, had worked effectively in their respective school divisions during the past three years. An interview guide, in a slightly modified form, was sent to those consultants whose names had been submitted by supervisors and teachers. Responses were received from ninety-seven supervisors, 174 teachers, and fifty-two consultants. Data from the responses were compiled, analyzed, and compared.

Supervisors, teachers, and consultants involved in this study considered pre-planning a very important factor in the effective utilization of consultant services. They believed that pre-planning should include (1) identification and pre-study of problems; (2) recognition of need for consultant help; (3) selection of consultant; (4) mutual agreement between consultant and school personnel as to objectives and ways of working; and (5) scheduling and other routine preparation for the consultant's work.

According to the respondents, the techniques most frequently used by consultants were demonstration, lecture, group discussion, and individual conferences. Specific techniques and combinations of techniques considered most effective by the largest number of individuals were (1) demonstration and group discussion, (2) group discussion, and (3) demonstration. A sharp discrepancy of opinion between supervisors and teachers was apparent concerning the relative effectiveness of the demonstration technique.

All of the supervisors and all except one of the teachers stated that consultants' personalities played an important part in determining the success or failure of consultant services.

Supervisors, teachers, and consultants made the following recommendations concerning pre-planning:

1. There should be more pre-planning on the local level than is now being carried out.
2. All school personnel who are to be involved in the work of the consultant should have a part in the pre-planning.
3. It is desirable for the consultant to participate in person in those pre-planning activities that deal with objectives and ways of working.
4. The program of consultant services should be based on problems that the teachers wish to study.
5. Specific information concerning the program and the nature of the help desired should be provided for the consultant well in advance of his visit.

Techniques recommended by respondents in the three groups were, in general, consistent in frequency with those rated most effective. Other recommendations concerning ways of working included

the following: (1) that consultants should use lecture as sparingly as possible, using instead informal ways of working; (2) that the ways of working should depend on various factors in a given situation; and (3) that consultants should make use of audio-visual aids whenever they can be used to advantage.

Members of all three groups recommended some form of post-conference evaluation and some form of follow-up activities subsequent to the consultants' visits.

237 pages. \$2.96. MicA54-2972

A COMPARATIVE STUDY OF THE CLOTHING AREA OF THE SECONDARY HOMEMAKING CURRICULUM IN A SELECTED COMMUNITY AND RELATED BELIEFS AND PRACTICES OF FAMILIES IN THAT COMMUNITY

(Publication No. 9944)

Amy Jean Holmblade, Ph. D.
Michigan State College, 1954

The purpose of the study was to examine the clothing area of the secondary curriculum in homemaking in a selected community in relation to the beliefs and practices of homemaking pupils and their parents with respect to clothing problems and in relation to the opinions of pupils and parents concerning what ought to be emphasized in the study of clothing. Four types of clothing problems were considered: (1) choosing and wearing, (2) buying, (3) making, and (4) caring for and repairing.

The setting for the investigation was a south-central Michigan community of 6,500 population. The 101 high school pupils in homemaking were largely daughters of farmers or factory workers, over half coming from rural homes. About a third of their mothers were employed outside their homes.

Information about beliefs and practices relative to clothing and opinions concerning desired emphases in clothing in the curriculum were obtained through questionnaires and interview schedules developed for the study. One questionnaire was answered by all the pupils; another was sent to all the parents and was returned by 84 per cent of them. A third of the pupils and their parents were interviewed; the pupils, at school, and the parents, in their homes. The data thus obtained were used to describe common beliefs and practices and variations within the groups. They were also used in examining problems in clothing of six selected pupils.

Descriptive information about the clothing area of the 1953-54 curriculum was secured from the homemaking teachers through conferences and examination of their daily planbooks.

There was apparently much family interaction in decisions concerning choosing and wearing clothing. Pupils wanted approval of parents, girl friends, and boys for their clothes. Many mothers thought their daughters were influenced in dress by other girls. Ready-to-wear garments had been obtained by almost

all pupils in the last year. The pupils seemed aware of the cost of apparel and were in general agreement with parents concerning expected costs of various garments and who should participate in their selection. In almost three-fourths of the families some home sewing had been done in the past year; the greater part involved the construction of cotton garments for women and girls. Most pupils took some responsibility for care of their own clothes and assisted their mothers with the care of clothes for others in the family.

The greater portion of the time and attention in the study of clothing in each of the homemaking classes had concerned the making of garments, an activity for which many pupils and parents had taken little or no responsibility in the past year. Almost all pupils and parents had indicated responsibilities and concerns in choosing and wearing, buying, and caring for and repairing clothing. Yet little time or emphasis had been accorded these areas. Such study as had related to them appeared appropriate in view of the usual responsibilities of pupils and concerns of parents. Generally, pupils and parents thought more than the present curricular emphasis should be given each of the four aspects of clothing in relation to problems of teen-age girls. Few pupils and parents favored emphasis in relation to clothing for other members in the families.

This study was intended to be illustrative of a type of study which might be initiated by homemaking teachers in their own communities as an aid to appraisal of the curriculum. It would seem that, in making curricular plans in clothing in this community, pupils, parents, and homemaking teachers might well examine the apparent disparities among the present emphases in clothing in the curriculum, the related beliefs and practices in families, and their own opinions concerning desirable curricular emphases.

278 pages. \$3.48. MicA54-2973

AN ANALYSIS OF SOME FACTORS ASSOCIATED WITH PERSISTENCE OF INTEREST IN TEACHING AS A VOCATIONAL CHOICE

(Publication No. 10,079)

Anthony Charles LaBue, Ed. D.
Syracuse University, 1954

This study was designed to analyze factors associated with persistence of interest in teaching as a vocational choice. The sample studied consisted of six groups of Syracuse University students; three groups of women and three groups of men. The women and men students were classified separately in the following categories: (a) those who had persisted in their interest in teaching as a vocational choice as indicated by completion of a program of teacher preparation and employment in a teaching position, (b) those who had indicated an interest in teaching as a career through the submission of a

preliminary application for admission to a program of teacher preparation but who did not enroll in such a program, (c) those who did not choose teaching as a career. There were fifty subjects in each of the groups, except for the male non-persistent group which consisted of a total sample of thirty-one subjects who had made a preliminary application over a three-year period. All of the subjects in the remaining five groups were selected through a random numbers procedure.

The experimental design involved the following four purposes: (1) identifying differences among the three groups of women students and among the three groups of men students; (2) determining the relationship between selected characteristics and the criterion, persistence of interest in teaching as a vocational choice; (3) determining the relationship between combinations of characteristics and the criterion; and (4) an inquiry into the nature of the reasons given by the non-persistent students for not persisting in their interest in teaching as a vocational choice and their present vocations or vocational goals. The data gathering devices included the following: The American Council on Education Psychological Examination; Cooperative English Test, Reading, The Cooperative Achievement Tests; The Bell Adjustment Inventory; The Kuder Preference Record; The Minnesota Multiphasic Personality Inventory; The Strong Interest Inventory Blank for Men; Application Form for admission to the School of Education, Syracuse University; Registrar's records; and an open-ended questionnaire.

The study seemed to support the following conclusions with respect to Syracuse University students:

1. Significant differences exist between female students who persist and those who do not persist in their interest in teaching as a vocational choice. The persistent group is not only superior in certain abilities but has less tendency toward personality maladjustment.

2. The differences between the women who persist in teaching and those who do not choose teaching are in the area of vocational and non-vocational interest tendencies rather than in scholastic abilities or personality traits.

3. Significant differences exist in the areas of achievement and interests between female students who do not persist in their interest in teaching as a vocational choice and those who do not choose teaching as a career.

4. Scholastic aptitude, reading ability, and personality traits of the female students are related to the criterion, persistence of interest in teaching as a vocational choice.

5. As contrasted with the persistent group, the men in the non-persistent group seem to have no clear-cut interest in teaching. The subject-matter content seems to be the main determinant of the teaching interest of these students. These men also possess significantly less social service interest and show concern for the low salaries paid teachers.

6. The major significant difference between male students who persist in teaching and those who do not

choose teaching is in the higher occupational interest level of the latter group.

7. Differences in various components of scholastic aptitude between students who persist in teaching and those who do not choose seem to be in favor of the teaching group or so small as to be statistically insignificant. 222 pages. \$2.78. MicA54-2974

**A STUDY OF THE RELATIONSHIP BETWEEN
THE STYLE OF TEACHER PARTICIPATION
IN THE TOTAL CLASSROOM GROUP AND
THE INTERNAL STRUCTURE OF
SUB-GROUPS IN THE CLASSROOM**

(Publication No. 9716)

John Thomas Lovell, Ed. D.
University of Florida, 1954

The purpose of the study was to investigate the relationship between the style of teacher participation in the classroom group and the internal structure of sub-groups in the classroom. The style of teacher participation was described in terms of teacher emotion, teacher participation in the interaction, and teacher influence on the group. The internal structure of the sub-group was described in terms of the activity, interaction, and emotional climate of the sub-group.

The study indicated that the style of teacher participation in the total group contributed significantly and is mutually dependent with the emotional climate, interaction pattern, and activity of sub-groups in the classroom. 280 pages. \$3.50. MicA54-2975

**TECHNIQUES FOR STUDYING CERTAIN
PROFESSIONAL ACTIVITIES OF TEACHERS**

(Publication No. 9718)

Walter B. Mathews, Ed. D.
University of Florida, 1954

The problem for this study was: (1) to identify activity patterns of a selected teacher sample; (2) to validate a brief methodology for studying professional activities of teachers within a school.

The investigation was developed within the framework of Phase I of the Leadership Project of the College of Education, University of Florida. It was a part of a group research pattern for institutional research, sponsored by the Southern States Cooperative Program in Educational Administration. With other studies developed within Phase I of the Leadership Project, this study was designed for the purpose of developing and validating research instruments and other techniques with which to test, in later phases of the Leadership Project, the central hypothesis: i.e., that the qualities of personality and ways of working of the official leader of a school influence, to a major

degree, human relationships, pupil achievement, program development, school-community relationships, and teacher activity within a school.

From July, 1952 until June, 1953, an intensive investigation was conducted in four selected school centers. A fifth center was used for a brief period of time to test the findings of the intensive study. Fifty-eight teachers from the five school centers comprised the teacher sample for the investigation.

The activity patterns of the teacher sample were identified by use of interview and observation techniques. Cumulative data collected by these techniques were processed to form the basis for the construction of a questionnaire-check list.

The questionnaire instrument was administered to the selected teachers. The investigator, working from the processed data obtained from interviews and observations, scored a form for each of the selected teachers.

An analysis of the data collected by the questionnaire-check list was made to determine the extent to which the desired information concerning teacher activity could be secured directly from the teacher through the use of the brief instrument. Involved in the analysis was a consideration of the validity and reliability of the instrument and the discriminatory power of the individual items.

On the basis of data obtained, and within the framework of inherent limitations of the procedures and the sample, the following conclusions would seem substantiated:

1. Teachers are concerned enough about the advancement of the profession to be willing to give time and energy to the development of research projects if they are convinced: (1) that the projects are worth while; (2) that they are making a contribution to research.
2. The teacher provides a more accurate source for information about the activities in which he engages than do the principal or other teachers on the same staff.
3. Discrepancies that occur in securing information about their activity patterns from teachers tend to occur not in the identification of the existence or nonexistence of an activity but in the identification of the frequency with which a teacher participates in the activity.
4. The interview technique, as described in this study, shows promise as a research tool for gaining from teachers a wealth of qualitative and quantitative data about the activities that teachers are actually performing.
5. Anecdotal recording of observation, as used in this study, provides a more graphic review of observable teacher activity than will normally be revealed through the use of a check list.
6. The questionnaire-check list developed within the study appears to be a reasonably valid and reliable means of investigating certain professional activities of teachers and seems to hold considerable promise for use in later phases of the Leadership Project.

157 pages. \$1.96. MicA54-2976

IMPROVEMENT OF RURAL TEACHER EDUCATION IN EGYPT

(Publication No. 9619)

Ibrahim Esmat Metaweh, Ph. D.
University of Minnesota, 1954

Adviser: Dr. Clifford P. Archer

The problem of this study is the utilization of the results of experience and research in rural teacher education in the United States and in other countries under UNESCO leadership to develop a program of improvement in Egypt and similar areas neighboring Egypt. The study consists of three parts:

1. The study of the historical and cultural setting and development of the Egyptian villages against which any improvement must be projected. Seven stimulating social forces were identified namely the ancient history of Egypt and its institutions, the impact of Eastern and Western cultures, the religious movements, Nationalism, Leadership, Democracy, and Cooperation. Several means of harnessing these powers towards progressively improving rural teacher education were discussed. Then the problems that rural teacher education has to face along the existing practices were discussed and supported by official statistics in an attempt to point out evident weaknesses and to suggest the type of education needed to participate in solving these problems. This part is mainly diagnostic.

2. An extensive analysis of 275 publications relevant to rural teacher education problems, including books, pamphlets, magazines, research bulletins, catalog issues, experiments, conferences, and reports was conducted. 243 publications were available from the United States covering the last sixteen years, and 32 publications were available from UNESCO, covering the last six years. Included were publications dealing with teacher education problems in general whenever publications dealing with rural teacher education problems were not present. Finally, out of these publications, 596 principles, objectives and trends in rural teacher education were extracted for their possible use in Egypt. They were arranged under the following headings:

- A. A shift in emphasis from subject-teaching to the needs of the child-study of human nature.
- B. Greater use of the activity method, direct experience, and creative expression.
- C. The importance of the professional as well as the personal growth of the prospective rural teachers.
- D. The increased emphasis on social understanding and social service.
- E. The increased use of the community resources and the schools' concern with raising the economic and social living of the community.
- F. How prospective rural teachers can help in encouraging international understanding.
- G. The use of a wide variety of teaching methods.
- H. The specific courses offered.
- I. The specific student organizations in the rural teacher education institutions.

J. Emphasis on In-Service education - Putting principles into practice.

These principles, objectives and trends were put in a questionnaire form and were sent by mail to 350 Egyptian and Non-Egyptian educators, rural and urban, who are engaged in teacher education, to consult their judgment. A combination of the analytical and synthetical methods was used in this part of the study. The questionnaire was pretested and validated by the experts. It covered the following areas:

- A. Personal information about the respondents
- B. Preparation of rural teachers
- C. Selection and Admission
- D. Board of Directors
- E. Location of the Institution
- F. Philosophy of rural teacher education
- G. The functions of the Institution
- H. The rural teacher education curriculum reconstruction
- I. The rural teacher education curriculum content.
- J. Methods of teaching in the Institution
- K. Student activities in the Institution
- L. Promotion and Examinations
- M. After Graduation.

3. The results of 121 questionnaires returned were reported in percentage forms. Forty-five suggestions and recommendations emerged, and were offered to the Ministry of Education in Egypt and some neighboring states. This part of the study is mainly prescriptive.

In summary a pattern of a democratic-scientific-humanistic-higher standard outlook was discovered throughout the study for the improvement of rural teacher education program. This pattern was adequately reflected in the forty five recommendations given.

304 pages. \$3.80. MicA54-2977

TEACHING AND NON-TEACHING BAC ALAUREATE DEGREE GRADUATES WITH INDUSTRIAL ARTS MAJORS: A COMPARATIVE STUDY OF FORMER STUDENTS OF EASTERN ILLINOIS STATE COLLEGE AIMED AT IMPROVED COUNSELING AND RELATED ASPECTS OF PREPARATION: THIRTEEN ITEMS ON RECORD, TYPES OF TEACHING AND NON-TEACHING POSITIONS, PRESENT STATUS, CAUSES OF SEPARATION, AND PROFESSIONAL ATTITUDES

(Publication No. 10,038)

Otho James Quick, Ph. D.
University of Minnesota, 1954

Adviser: Homer J. Smith

The study of teaching and non-teaching baccalaureate degree graduates was undertaken to compare data on a sample of the two groups to determine if any differences on selected items existed. This information about the groups was for future use in counseling students at the undergraduate level of professional training, possible selection of teaching

candidates, and for subject matter content in professional courses.

The data were gathered from the records and by mailed survey instruments from 258 (82.7 per cent) of the 312 graduates of Eastern Illinois State College with industrial arts majors. The dates of graduation ranged from 1926 through 1953. The survey instruments also furnished the basis for classification into the teaching and non-teaching groups. Statistical comparisons were made by using formulas for "F," "d," "t," "z," and "chi-square" tests.

The review of the literature related to selection of potential teaching candidates and follow-up of graduates of teaching curricula did not furnish an analytical survey of teaching and non-teaching graduates in the field of industrial arts education.

The group of Eastern graduates was compared with similar groups from The Stout Institute and the University of Minnesota on the measure of psychological examination scores. The sample of 258 was compared with the total group of 312 graduates on four measures.

The canvass of thirteen items from the records revealed no significant differences between the two groups on: dates of graduation, psychological examination scores, minor subject selections, occupations of guardian at time of graduation, units of high school science, units of high school mathematics, units of high school industrial education, total grade point averages, professional education grade point averages, college industrial arts grade point averages, number of participations in extracurricular activities, number of offices held in extracurricular groups, and averages of ratings by teachers on Placement Bureau forms.

The survey instruments furnished comparisons on sixteen items concerning the present status of the respondents and on reactions to 155 opinion statements related to teaching relationships.

The present status of the two groups revealed significant differences on: yearly salaries or incomes, singing or playing a musical instrument as a recreational activity, participations in social welfare groups, participations in service organizations, and the reason for leaving last industrial teaching position because of inadequate salary.

Analyses of the opinion statements were made on the bases of classification into teaching and non-teaching groups and classification into groups according to dates of graduation. Results indicated the teaching group was less inclined to be undecided and more inclined to answer strongly agree or strongly disagree than the non-teaching group. The teaching group was well adjusted, had faith in pupils, was sympathetic and understanding of pupil behavior, and was democratic in pupil relationships. The non-teaching group felt insecure, was suspicious of pupil behavior, and was either autocratic or did not know what behavior was desired of pupils. Comparisons by dates of graduation indicated that changes in educational and social thought were reflected in the reactions to opinion statements. The area of opinion statements which sampled attitudes of industrial arts baccalaureate

degree graduates seemed to offer the most promise for future work with undergraduates.

260 pages. \$3.25. MicA54-2978

THE RECRUITMENT AND ADMISSION OF STUDENTS TO TEACHER EDUCATION

(Publication No. 8940)

Earl Allen Roth, Ed. D.
Indiana University, 1954

Chairman: Elvin S. Eyster

The Problem

The problem is a study of the thought influencing the development of standards for recruitment and standards for admission to teacher education in the United States.

Procedure

The historical method of research was used to discover the past trends in policies and practices relative to recruitment and admission, and the philosophical method was employed to ascertain the basic concepts influencing the development of standards. All data were obtained through the facilities of the Indiana University Library. A selected bibliography was compiled after which each reference was abstracted or summarized and analyzed to determine the basic concepts underlying the thought regarding policies and practices in recruitment and admission. Three educational eras were used for the organization and presentation of the basic concepts. The issues resulting from different opinions regarding recruitment and admission were indicated.

Concepts

Two types of concepts – transitory and persistent – underlie the development of standards for both recruitment and admission. These concepts were classified according to philosophy, function, responsibility for establishment, and method of fulfillment.

Standards for recruitment in teacher education.

Recruitment has been thought necessary by educators for the survival of teacher-training institutions, for the development of an educational system, and for the maintenance of individual rights in a democracy.

Recruitment programs have had four basic functions: to aid in solving basic educational problems, to develop public understanding of educational institutions and public appreciation for the teacher's work, to improve the teacher's personal qualities and professional qualifications, and to induce a sufficient number of individuals to apply for admission to facilitate selection.

Responsibility for establishing standards for recruitment and for recruiting has been held at various times by: nonteaching personnel within teacher-training institutions, secondary-school teachers, teaching personnel employed by teacher-training institutions, and laymen.

Personal solicitations, direct appointments, promotional activities and publicity programs, and public relations programs have been the direct methods used for recruitment. The development of a professional status for teaching has characterized the indirect method for recruitment.

Standards for admission to teacher education.

The needs for standards for admission have been revealed to be: prerequisite for educational advancement, essential in the absence of national policies and practices in education, necessary for maintenance of democracy, essential for counteracting the influences of social and economic crises, and imperative in a continuous educational system.

The functions characterizing standards for admission have been: to aid in establishing an educational system, to assist in stimulating the upgrading of personal and professional qualifications of teachers, to help maintain a professional status for teaching, and to promote democratic principles.

Teacher-training institutions, state boards of education, professional associations for teachers, and laymen have each held the responsibility for establishing standards for admission.

Eligibility for admission has been based on four factors: scholastic achievement, personal and social attributes, maturity, and academic achievement. The devices used for determining a student's conformity to standards for admission were: objective measurements, subjective appraisals, and certificates of graduation.

Current Issues

Conflicting opinions regarding both recruitment and admission to teacher education resulted in seventeen current issues. Five unresolved issues relating to standards for recruitment were classified as follows: methods - 3; philosophy - 1; function - 1; and responsibility - 0. Twelve issues found in current educational thought regarding standards for admission were classified according to: methods for determining conformity - 7; philosophy - 3; function - 1; and responsibility - 1.

335 pages. \$4.19. MicA54-2979

EDUCATION, THEORY AND PRACTICE

A PROJECT IN THE COOPERATIVE PRODUCTION OF INSTRUCTIONAL GUIDES FOR TEACHERS OF SCIENCE

(Publication No. 10,020)

John Bryant Chase, Jr., Ed. D.
University of Virginia, 1954

The purposes of this study were: (1) to discover the desires of selected teachers of science throughout the United States for instructional guides in science; (2) to produce a sample instructional guide in

science, meeting the desires of the teachers selected; and (3) to use the sample guide to help teachers produce cooperatively through classroom trial other instructional guides.

State Departments of Education in thirty-eight states suggested 324 teachers who might be interested in joining this project. Each of the 324 teachers was asked by questionnaire to recommend topics for which he would like to have instructional guides. To determine what teachers felt should be included in an instructional guide, seventeen proposed items were listed, and teachers were asked to revise and supplement the list. One hundred and thirty-two teachers from thirty-six states responded.

After an analysis of the topics recommended for development, Microscopic Living Things in Relation to Human Activities was selected as the topic on which to develop a sample instructional guide. It was possible to identify the items which participating teachers proposed to be included in an instructional guide. At this time participating teachers were asked to give ideas that they considered especially useful in teaching a unit on Microscopic Living Things in Relation to Human Activities.

To discover the desires of science teachers in Virginia for instructional guides, 736 teachers were asked by questionnaire to indicate at least three topics for which they would like to have instructional guides. A proposed outline for a science instructional guide was presented; teachers were asked to check the items which should be included; and to give their ideas for handling the items to make them most useful. Three hundred and eighty-two Virginia teachers responded.

The sub-divisions for a sample instructional guide were determined by an analysis of those proposed by participating teachers and by writers in the field of science education. For example, all teachers thought that an instructional guide should include a list of educational films. Participating teachers also suggested items to include under the sub-headings of a sample instructional guide on Microscopic Living Things in Relation to Human Activities. For example, particular films that would be useful in teaching this topic were suggested. Relying on this help the writer produced a sample instructional guide on Microscopic Living Things in Relation to Human Activities. The sample guide was mailed to participating teachers to use in teaching this topic, and they were asked to report their ideas for improvement of the guide.

Superintendents and directors of instruction from fifty-four school divisions in Virginia suggested 129 teachers of high school science whom they thought would be qualified and interested in working with the writer to produce instructional guides. One hundred and one of these recommended teachers later expressed personally a willingness to help in the cooperative production of additional guides similar to the sample guide on Microscopic Living Things in Relation to Human Activities. The writer collected, organized, and edited the suggestions submitted by cooperating teachers. He used these suggestions to produce instructional guides on four additional topics: (1) The Earth's Weather and How It Affects Us,

(2) Heredity and Evolution, (3) The Nature of Matter and Chemical Energy, and (4) The Nature and Use of Electricity.

Throughout this experience, there was interest on the part of participating teachers, personnel of the state departments of education, and division superintendents. There was a similarity between the topics suggested for instructional guides by participating teachers outside Virginia and those in Virginia in the fields of chemistry and physics. There was little similarity between the topics suggested by these two groups of teachers for general science and biology. Participating teachers were in agreement about the items that should be included in an instructional guide.

There was interest on the part of participating teachers in cooperatively producing instructional guides. However, there was little evidence of any widespread production and use of instructional guides by teachers. For this reason, it was one of the recommendations of this study that other instructional guides be produced and used statewide as well as in particular school districts.

366 pages. \$4.58. MicA54-2980

EXPERIMENTAL STUDY OF SELECTED INSTRUCTIONAL MATERIAL IN SOCIAL CLASS AT THE SECONDARY LEVEL

(Publication No. 9713)

Thomas Jordan Hill, Ed. D.
University of Florida, 1954

The purpose of the study was to test the hypothesis that the organized study of selected materials in social class are useful for helping boys and girls in the areas of (1) attitudes toward self, (2) attitudes toward others, (3) attitudes toward social justice, (4) attitudes toward democracy, and (5) choice of friends. What You Should Know About Social Class by W. Lloyd and Mildred Hall Warner was selected as the basic material for the study.

The plan of the study involved four experimental and four control groups of high school students at the P. K. Yonge Laboratory School; an experimental and a comparable control group at the ninth, tenth, eleventh, and twelfth grade levels. At a given time, the following instruments were administered to an experimental and its comparable control group:

1. Attitudes Toward Self and Others by E. Lakin Phillips
2. Social Justice Scale by A. C. Rosander
3. Democracy Scale by A. C. Rosander
4. Ohio Social Acceptance Scale by the Euclid Elementary Teachers in connection with the College of Education, the Ohio State University.

The experimental group then began a unit of work planned around What You Should Know About Social Class by W. Lloyd and Mildred Hall Warner. At the close of the unit, the instruments were again administered to the experimental and the control groups. For purposes of more uniform procedure, the writer

administered all instruments. The writer also sat with the experimental groups during their study of the selected social class materials for the purpose of observing and recording materials and methods of teaching, and describing the reactions of the boys and girls through their own comments.

The data were then compiled to see what differences, if any, had occurred between before, and after, administration of the instruments. Tests of significance were run on the data to see whether or not differences in change between the experimental and the control groups were statistically significant. The data were further analyzed visually in an attempt to detect any consistent trends.

The data which were collected show that in no case did the experimental groups benefit more in the areas tested than did the control groups. Therefore, the original hypothesis is not tenable within the limitations of the study.

Further study is recommended (1) to test materials and methods less limited than those used in developing the experimental units described in this study, and (2) to eliminate, insofar as possible, the teacher as a factor in the outcomes of the experiment.

175 pages. \$2.19. MicA54-2981

ACHIEVEMENT IN PHYSICS AT THE SECONDARY SCHOOL AND JUNIOR COLLEGE LEVELS WITH IMPLICATIONS FOR GRADE PLACEMENT OF CONCEPTS

(Publication No. 9691)

Lloyd Kenneth Johnson, Ph. D.
University of Nebraska, 1954

Adviser: Harold E. Wise

Statement of the Problem

The problem of this study has been to seek an answer to the following questions:

1. To what extent is there an apparent duplication of effort to develop understandings of selected principles of physics at the junior high school, the senior high school, and the junior college levels?
2. Is there a significant difference in the extent to which functional understandings of these principles are currently being developed in science courses at the junior high school, the senior high school, and the junior college levels?

The study was based on principles of sound, static electricity, and magnetism which are presented in approximately the same manner in selected text books for ninth grade general science, high school physics, and college physical science survey courses.

A test was constructed to measure understanding of these principles. It was refined on the basis of item analysis following its administration to trial groups.

This test and an intelligence test were administered to 845 students in thirty-one schools. Eleven classes of general science, twelve classes of physics,

and eight classes of physical science survey were included.

Comparisons were made by the methods of analysis of variance and analysis of covariance with the effect of intelligence controlled. Group mean scores were used as the sampling units.

Findings:

When classes are compared as wholes without regard to previous preparation of the students in science, the achievement of physics classes is significantly greater than the achievement of physical science survey classes. The difference is increased when the effect of intelligence is controlled.

Similarly, when classes are compared as wholes, the achievements of both physics classes and physical science survey classes are significantly greater than the achievement of general science classes. When the effect of intelligence is controlled, however, the differences in achievement are no longer significant.

The contribution of a physics course in addition to general science is greater than that of a physical science survey course in addition to general science. When the effect of intelligence is controlled, neither increase in achievement is significant at the one per cent level. However, the increases that may be attributed to the study of physics is significant at the five per cent level.

The contribution of a physical science survey course in addition to physics alone does not result in a significant increase in achievement.

The general science classes demonstrated almost as complete an understanding of the principles as did the science survey groups who had taken neither physics nor general science.

Conclusions:

On the basis of evidence revealed by this study, there appears to be considerable unnecessary duplication in the development of understanding of principles of sound, static electricity, and magnetism between ninth grade general science, high school physics, and physical science survey courses at the college level.

In so far as the development of understandings of the principles of sound, static electricity, and magnetism used in this investigation is concerned:

a. Students who have completed ninth grade general science can possibly profit by a course in high school physics. However, students who have completed both ninth grade general science and high school physics probably cannot, under present instructional practices, profit by a physical science survey course at the college level.

b. Students who have completed ninth grade general science probably cannot, under present instructional practices, profit by a physical science survey course at the college level.

It would appear, therefore, that in planning a program of science for general education, the major effort to develop understandings of the principles of sound, static electricity, and magnetism used in this

study should be concentrated in ninth grade general science.

156 pages. \$1.95. MicA54-2982

A STUDY OF THE FACTORS ASSOCIATED WITH MUSIC PARTICIPATION BY SECONDARY SCHOOL PUPILS IN THE SUBURBAN AREAS OF MINNEAPOLIS AND ST. PAUL

(Publication No. 10,030)

Joseph Weiland Jung, Ph. D.
University of Minnesota, 1954

Adviser: Robert J. Keller

The general purposes of this study were three-fold: (1) to survey student participation in musical activities in and out-of-school, (2) to ascertain whether musical participation is associated with measures of mental ability, musical aptitude, or musical achievement, and (3) to interpret these findings in terms of implications for the role of music in secondary school curriculums.

A sample of 608 pupils, 19 from each of two sections of tenth and twelfth grade English classes in eight schools, was selected by random procedures. The representativeness of this sample was determined by tests of homogeneity for the separate subgroups by school, grade, and sex.

Four measuring instruments were used to obtain the basic data. These instruments included a questionnaire (Survey of Musical Activities of High School Students), a battery of music aptitude tests (Tilson-Gretsch Musical Aptitude Test), a music achievement test (Aliferis Music Achievement Test), and an intelligence test (Otis Quick-Scoring Mental Ability Test).

Participants were generally divided into three approximately equal groups corresponding to low, medium, or high participation indices, the latter information being determined from time reported spent during a one week period in various kinds of musical activities. The major hypotheses under test stated that no differences exist among these three groups in terms of the separate measures of aptitude or achievement.

Findings were presented in terms of the typical student or the typical practice in the public suburban secondary schools with respect to the following questions: (1) Who were the participants in this study? (2) What was the nature of their musical activity? (3) How well did these students perform on measures of musical aptitude and achievement? (4) To what extent was participation in musical activities associated with measured musical aptitude or achievement?

Results of this investigation should have implications for improving the music programs in suburban secondary schools. Though these findings must be restricted to the student population on which they were based, they appear to have implications for similar communities and possibly for other schools as well. Some of the findings and associated recommendations follow:

1. The high school students are at present participating largely in out-of-school passive listening situations. The school needs to guide these experiences in order to improve pupils' musical appreciation and possibly their tastes.

2. The present music curriculum attracts greatest participation from the average and above average students. In contrast to these groups, students with little musical aptitude or achievement spend little or no time in school musical activity. In addition, the musically talented students appear to be receiving not much more attention in music than students of average ability. This apparent lack of opportunity for musical expression or appreciation on the part of both extreme groups should be remedied if the schools are to offer a well-rounded music curriculum.

3. Evidence in the study showed that the parents of musically talented children participate no more in musical activities than do parents of non-talented boys and girls. Since the home thus does not seem to be providing an environment which stimulates the musical interest and participation of children, the school should assume more responsibility in this area.

4. Time spent in-school musical activity was found to be a rough indicator of musical aptitude. Pupils who spend the least amount of time in school music generally earned the lower scores on the musical aptitude tests.

The present study becomes most useful when it is employed as background against which the status of music in each suburban school may be compared. This information plus an understanding of factors affecting pupil participation should be helpful in improving the musical experiences provided by the school curriculum.

278 pages. \$3.48. MicA54-2983

SCIENCE EDUCATION IN THE IRAQI SOCIETY

(Publication No. 10,178)

Abdulrahman M. Khalid, Ph. D.
Columbia University, 1954

Chairman: Hubert M. Evans

One of the major characteristics of the last three centuries in the West has been the growth of modern science. Through modern science Western man has raised his standard of living, improved his health and sanitary conditions, discovered efficient means for utilizing his natural resources for the improvement of living, altered many of the inherited beliefs concerning nature including man, reduced the influence of magic and superstition, and widened the scope of the employment of scientific method.

Many of these achievements have not yet penetrated deeply into Iraqi life. The general standard of living is very low, unhealthy and insanitary conditions abound, most of the natural resources are either underdeveloped or abused, and superstition permeates

many phases of life. Modern science has much to offer for the improvement of these conditions. Such improvement can be, and may have to be, achieved through education, more specifically science education.

The Problem

The central problem of this study was to propose a scheme for the reconstruction of Iraqi science education which might lead to an improvement in individual and societal life conditions. In other words, the problem was to make proposals for a science education which would make a contribution to the public welfare in light of the prevalent conditions. One of the major constituents of the problem was conceived to be the nurture of the Iraqi young and consequently the public, in the scientific method of establishing and verifying beliefs. It was also hoped, as a result of such a science education that the Iraqi people may recognize whatever may be the values of science for the fulfillment of their needs and the solution of their problems.

Procedure

In order to develop an adequate scheme for a proposed reconstruction in Iraqi science education, four major questions were raised and answered.

First, what are the salient features of Iraqi society, and what is the significance of these features for education in general and science education in particular? An attempt was made in Chapter I to deal with the total social situation by investigating some population problems, the major social movements and the principal social institutions. The main object was to discover the major social problems in Iraq and their bearings on education, especially science education.

Secondly, what are the prevalent theories and practices in the major Iraqi educational institutes, and to what extent do these institutes tend to improve the social situation? Chapter II was an attempt to answer this question by investigating the theory and practices of the Iraqi educational institutes in order to discover their weaknesses and strengths in the light of social needs and an adequate conception of learning. The discussion included a consideration of the elementary, secondary and vocational schools as well as higher and teacher-preparing institutes. The aims, teaching methods and offerings were described and examined. General proposals were advanced for the reconstruction of Iraqi education.

Thirdly, what is the present status of science education in Iraq, and what are the points of strength and weakness inherent in it? Chapter III delved into a detailed answer of this question by describing the aims, teaching methods, the nature and scope of the content, the examination system in science education in the Iraqi elementary and secondary schools as well as teacher-preparing institutes. The major problems and issues were indicated, and the underlying assumptions were made explicit.

Also, what potentialities does modern science hold in promise for the improvement of Iraqi life by

way of contributions to the solution of the present social problems and fulfillment of its urgent needs? Chapter IV was an endeavor to answer this question by investigating some of the scientific resources that are available to the Iraqi people. This chapter describes scientific activities outside educational institutes and the public response to scientific achievements. In addition, it specifies the problems which aggravate the social situation and indicate the potentialities of modern science for their solution.

In the light of the discussions of these four chapters, Chapter V undertakes to propose a scheme for the reconstruction of Iraqi science education. The proposed flexible, but comprehensive, scheme covers the major aspects of science education. Before proposing the scheme the inadequacies and shortcomings of the present arrangements in Iraqi science education were brought to a focus. These inadequacies and shortcomings were related to objectives, content, teaching methods, the examination system, centralization in science education, and the preparation and control of science teachers. The scheme of reconstruction included basic directions for science education in Iraq, proposals for new objectives and outlook, for the selection and organization of science content, and for the improvement of the methods of teaching. An eleven-year integrated science program was proposed for the Iraqi public school. Proposals were also advanced for improving the preparation of science teachers and the in-service education of science teachers. Furthermore, a policy for the decentralization of control was discussed, and some of the problems requiring further research in science education were indicated.

It is hoped that this study may contribute to the improvement of Iraqi science education, which may eventually improve and enhance the welfare of the Iraqi people. 313 pages. \$3.91. MicA54-2984

AN EXPLORATION INTO THE
RELATIONSHIP OF PHYSICAL GROWTH
PATTERN AND CLASSROOM BEHAVIOR
IN ELEMENTARY SCHOOL CHILDREN

(Publication No. 9948)

Gerald Thomas Kowitz, Ph. D.
Michigan State College, 1954

The purpose of the study was to explore the possible relationship existing between growth pattern and classroom behavior in elementary school children. Although much work has been done cross-sectionally attempting to relate morphology or somatology to personality or behavior, the results, at best, have been inconclusive. It was believed that if such a relationship existed, it would be discovered by using a developmental approach involving generalized units of physical maturity, since the cross-sectional methods usually employed only magnitude measurements.

Teacher judgments were used to evaluate the appropriateness of the child's behavior for the instructional situation.

Ratings were obtained from the respective teachers on all the third- and fourth-grade pupils of the Holt, Michigan, school system. The 63 cases selected represented approximately the upper and lower quarters of the total group. The groups were equated for third and fourth graders and for boys and girls. This resulted in four groups: high boys, low boys, high girls, and low girls.

The longitudinal height and weight records of the selected cases were obtained from the Child Development Laboratory, School of Education, Michigan State College. Using the Courtis Technique, Gompertz equations were calculated for the individual data. The constants of these equations, maximum, rate, and incipency, were averaged in order to obtain a curve of constants for each of the four groups. These curves were then compared statistically. It was found that among the height constants, highly significant differences appeared between the high groups and the low groups. Between the sexes within the groups, only one true difference appeared. The high girl group was growing to a maximum 0.6 inches greater than that of the high boy group.

Among the weight parameters, only one true difference was found. The high girl group was growing at a rate significantly higher than the low girl group.

It was concluded that any of the three height constants would differentiate the groups with regard to their behavior ratings. The weight constants, however, would not.

An attempt was made to determine whether or not the usual cross-sectional methods would discriminate between these groups. The mean height and ages were determined for each group for a certain date. Statistical comparisons indicated no differences between the groups. Since a difference in pattern did exist, a comparison of the percentage of development in height for the four groups was made. Highly significant differences were found between the high and low groups, but no differences were found between the sexes within the groups.

It was concluded that a definite relation exists between the developmental pattern in height and the classroom behavior of elementary school children. Furthermore, it was found that this relation is reflected in the level of development rather than in the achieved magnitudes. Those children receiving the higher behavioral rating were more highly developed physically. 103 pages. \$1.29. MicA54-2985

**A STUDY OF CERTAIN SELECTED
ELEMENTARY SCHOOLS FOR THE PURPOSE
OF DEVELOPING CRITERIA FOR THE
APPRAISAL OF THE ELEMENTARY SCHOOL**

(Publication No. 10,081)

George Manolakes, Ph. D.
Syracuse University, 1954

Adviser: William D. Sheldon

This study presents the results of an investigation of thirty selected elementary schools that was conducted in order to identify those characteristics that contributed to the effectiveness of these schools and that might serve as criteria for the evaluation of an elementary school.

The investigation of the elementary schools included in this study was conducted by research teams organized for this purpose. The procedures used by these research teams included: (a) meetings with administrators, teachers, parents, and children; (b) interviews with teachers and administrators; and (c) observations of classroom and school activities. The function of the research teams included not only the identification of the characteristics or features of the selected elementary schools, but also the description of those policies and practices that were an expression of these features. The study further provided the opportunity to examine the effectiveness of policies and their effects on the teachers, children and parents that were influenced by them.

This study resulted in the identification of twenty-three features which were developed from three-day investigations conducted within each selected school by a research team. These features were organized under five major classifications.

1. The Elementary School Develops a Broad Range of Skills, Understandings, and Attitudes. Features one through six describe the attention of these selected schools to the fundamental skills and knowledges, to the emotional development of children, to the social development of children, to the development of desirable personal characteristics, to health and physical development, and to the creative and appreciative experiences of children.

2. The Elementary School Selects Suitable Means for Promoting the Growth of Children. Features seven through eleven describe the procedures that had been developed by these schools to provide for the individual differences among children, for providing meaningful and purposeful learning experiences, for pupil participation in planning their learning experiences, for the evaluation of the growth of children, and for meeting the needs of children that arise from conditions peculiar to the community.

3. The Elementary School Develops Policies that Contribute to the Effectiveness of Learning Experiences. Features twelve through fifteen describe the freedom of these selected elementary schools to adapt their programs to meet their problems, the consideration of time in the programs of these schools, the procedures developed for the classification of children, and their efforts to help children during periods of transition.

4. The Elementary School Effectively Uses the Resources of the School and the Community in the Learning Experiences of Children. Features sixteen through eighteen describe the physical facilities, the involvement of the human resources within these selected elementary schools, and the involvement of the physical and human resources of the community in the experiences of children.

5. The Elementary School Sustains the Dynamic Quality of its Program through Leadership and the Cooperative Efforts of the School Staff, Children and the Community. Features nineteen through twenty-three describe the leadership function, the participation of the school staff, children, parents and members of the community in the development of the program, the efforts of the schools to maintain a competent staff, and the awareness of these schools to their responsibilities as agencies of their communities.

Each feature is described in detail in terms of the ways in which it was expressed in these selected elementary schools. In the discussion of each feature, references to the research and literature are included as source materials for the further description and definition of the practices and policies described. The comments of administrators, parents, teachers and children are used to present the reactions of school and community members.

The features of the selected elementary schools included in this study are condensed in the final chapter as a guide for the appraisal of an elementary school. 364 pages. \$4.55. MicA54-2986

**DUTIES OF THE DIRECTOR OF ELEMENTARY
EDUCATION IN SELECTED SCHOOL
SYSTEMS IN MISSOURI**

(Publication No. 9189)

Glen Henry Martin, Ed. D.
University of Missouri, 1954

Major Adviser: L. G. Townsend

Purpose: To analyze the duties of the director of elementary education in selected public schools in Missouri and to compare those duties with a set of criteria established from the writings of selected authorities in the field of elementary education.

Method of Research: The data for this study were secured from personal interviews with directors of elementary education in seventeen schools located in sixteen counties of Missouri. Bulletins and other publications of the schools participating in the study and three day diaries maintained by the directors of elementary education were also collected and examined. The data thus secured were related to criteria established from published writings of authorities in elementary education.

Summary:

- (1) The determination of a suitable title for the position of director of elementary education

and the determination of the duties to be performed by the directors of elementary education varied considerably due to local adaptations.

- (2) A review of the statements of objectives of the schools studied revealed an effort to operate the schools as institutions of society for the perpetuation of those skills and knowledges considered desirable by society.
- (3) The majority of interviewed directors assisted their superintendents in interviewing prospective elementary teachers, assigning teachers, and furnished information for an appraisal of the quality of teaching.
- (4) Although most of the directors of elementary education stated that improving the instructional program was a major justification for their position, routine clerical duties and administrative details prevented sufficient time being devoted to the instructional program.
- (5) In attempting to improve the instructional program, the directors of elementary education made their training experience available to the teachers and principals primarily on a voluntary basis.
- (6) Supervisory help by the director of elementary education was provided through classroom visitation, demonstration teaching, teacher visitation and conference, standardized and locally developed tests, bulletins, and instructional aids.
- (7) The directors of elementary education helped in the development of professional growth of the staff through workshops, faculty meetings, bulletins, professional libraries, encouragement of advanced study in extension and correspondence courses and attendance at summer schools.
- (8) Successful efforts to secure pertinent information in order to provide effective guidance and counseling when needed were reported by several directors of elementary education.
- (9) To acquaint the local community of the elementary program, directors of elementary education used local newspapers, radio programs, bulletins to patrons and group meetings.
- (10) There was no general pattern of budgetary responsibility required of the directors of elementary education, although a majority assisted in the administering of the elementary budget after its formulation.
- (11) The ordering of books and supplies and their delivery were included in the responsibilities of the director of elementary education.

213 pages. \$2.66. MicA54-2987

THE DEVELOPMENT OF A MULTIPURPOSE JOB ANALYSIS METHOD FOR A SELECTED NAVY RATING

(Publication No. 9772)

Daniel John Paolucci, Ph. D.
Cornell University, 1954

The Problem

Technological progress resulting from research, engineering, and production advances has led to significant changes in industrial machinery in general, and such derivative fields as Navy weapons in particular. Rapid strides have been and are being made in the development of semi- or fully-automatic equipment incorporating electrical, electronic and mechanical mechanisms. The performance of a single-purpose analysis for a specific user, on this complicated equipment, is no longer a satisfactory procedure economically. This study has been undertaken to formulate a method for a multipurpose analysis of a selected Navy occupation (Gunner's Mate) which would provide a procedure for collecting and sharing data and information to meet the needs of Training, Billet and Qualifications, and Classification and Survey Research Branches of the Bureau of Naval Personnel.

Procedure

A general discussion of the objectives of the study was held with the representatives of the above-mentioned users. Personal interviews were held with appointed members of each branch and the stated needs were established, examined, and reviewed in terms of common information required.

A weapon of recent development, incorporating the latest technological improvements, was selected to serve as the medium for the pilot study. The ordnance publications relating to the selected weapon were studied, and preliminary trips were made to an installation where the weapon was available for observation. The Gunner's Mate, Class "B" School's course of study was examined in terms of content and time devoted to instruction on weapon components and/or weapon areas.

A review of the literature on job and trade analysis practices preceded the preparation of schedules. The schedules listing the tasks were divided into the following areas: (1) mount operation, (2) lubrication and/or maintenance, (3) adjustments, (4) disassembly and reassembly, (5) trouble analysis, and (6) casualty reporting.

Vessels having the selected weapon were visited while in port and an analysis was performed, using the schedules. Ship logs were studied for frequency of tasks, and types and frequency of casualties. Weapon personnel participated in the study, and the performance of each task in the schedules was checked against ordnance publication literature. Interviewing procedures and schedules were modified and/or revised to meet conditions encountered in the Fleet. Approximately ten percent of the selected weapons installed in the Fleet at the time of the study were surveyed. The data and information collected were discussed periodically with the named branch

representatives to evaluate the effectiveness of the multipurpose data collecting schedules.

Conclusions

1. The multipurpose job analysis method developed, appropriately used by trained analysts, can effectively meet the needs of the specified users of the study.

2. Interpretation of collected data and information by users, on a cooperative basis, will effect a closer coordination of effort, and will result in a clearer understanding of and the desired action on the total program faced by Training, Billet and Qualifications, and Classification and Survey Research Branches.

3. The use of ordnance publications, engineering and design centered, as training manuals by School and Fleet training personnel is not in the best interests of the trainee, the instructional staff, or the Navy. The development of training manuals, using the present ordnance publications as sources of technical information, will assist the training personnel to do a more effective teaching job.

4. There should be implications from the study that apply to the work of personnel departments of industrial organizations. The employment, training, and wage and salary sections of the personnel department may study the proposed method for the possibility of coordinating their efforts. This would mean that specific activity requirements instead of the traditional functional approach would determine the pattern for solution of many personnel problems.

5. The casualty reporting aspect may, with revisions adapted to particular needs, be used by training departments in industrial organizations to determine needs and assist in establishing training programs designed to deal effectively with machinery maintenance requirements resulting from the trend toward automation. 249 pages. \$3.11. MicA54-2988

THE EFFECT OF STUDENT-SELECTION OF ADVISER ON RAPPORT

(Publication No. 9149)

Charles Walter Southard, Ed. D.
University of Illinois, 1954

This study was an investigation of the effect of student-selection of adviser on rapport (student's satisfaction with the counseling relationship). Specifically, the problem was: Is there a significant difference between selecting and non-selecting students in their degree of satisfaction with the counseling relationship?

The perceptions of student-advisees who had just experienced a counseling relationship with their advisers were investigated. Thirty students (college freshmen) who selected their advisers were compared with thirty students for whom advisers were assigned. Each of fifteen teacher-advisers counseled two students from each group, i. e., two students who selected him and two who did not select him but were assigned

to him. Each adviser met with a different student each day for four different days in one week.

The writer also investigated adviser perceptions of the same counseling relationships.

The writer collected data through the use of a Likert rating scale of 60 statements descriptive of the counseling relationship. This relationship consisted of five dimensions: communication, status, security, emotional distance and responsibility. The reliability of the total test was reasonably high; therefore, considerable confidence was placed in the results obtained using this instrument.

Analysis of variance was used to determine any significant differences between selecting and non-selecting groups. Conclusions and implications are as follows:

1. In these student-adviser relationships the method (student-selection of adviser) did not increase student rapport significantly at any dimension in the counseling relationship, and, regardless of selection or non-selection, students varied significantly from adviser to adviser in their degree of satisfaction with the counseling relationship. This means the adviser was a more important factor in determining rapport than was the method of selection of an adviser.

2. Individual differences in rapport existed among advisers regardless of the method of selection. Moreover, statistically significant differences existed between advisers when selected and the same advisers when not selected in their degree of satisfaction with communication, security, and responsibility in the counseling relationship.

3. Results of this study indicated very slight differences among students in their concepts of an ideal counseling relationship and very slight differences between students and advisers with reference to their ideals. These results defined a composite ideal relationship found among students and teachers. 89 pages. \$1.11. MicA54-2989

AN EXPERIMENTAL STUDY TO DETERMINE THE COMPARATIVE EFFECTIVENESS OF TWO PATTERNS OF TEACHING VOCATIONAL AGRICULTURE

(Publication No. 9928)

Orville Eugene Thompson, Ph. D.
Frederick Kwai Tuck Tom, Ph. D.
Cornell University, 1954

The purpose of this investigation was to determine the comparative effectiveness of two patterns of teaching vocational agriculture. In recent years, leaders in the field of Agricultural Education in New York have promoted with vigor a pattern of teaching herein referred to as an "experimental pattern." When compared with the "conventional pattern," i. e., the pattern commonly used by teachers within the state, certain dissimilarities appear. Among the differences are the following features which are present in the experimental pattern but absent from the conventional:

1. The teacher negotiates with the parents to insure that the pupil has some responsibility at home for the solution of the problem to be studied.
2. The teacher has the pupil state the problem as it exists in his own specific situation.
3. The teacher has the pupil state his specific responsibility for solving this problem.
4. The teacher has the pupil identify those major decisions he must make in order to solve the problem.
5. The teacher has the pupil determine those physical skills he needs to learn to solve the problem.
6. The teacher has the pupil analyze each decision to determine the important factors which should be considered.
7. The teacher has the pupil seek necessary references and other sources of information.
8. The teacher has the pupil plan how to study and describe the home situation relative to each decision.
9. The teacher has the pupil plan how to discover recommended practices for each decision.
10. The teacher has the pupil plan how to make each decision.
11. The teacher has the pupil follow his plans drawn up in items 8, 9, and 10.
12. The teacher has the pupil evaluate his own progress on the basis of quality of plan, degree of adoption, and degree of responsibility.

Three measures of achievement were used to compare the effectiveness of the two patterns, namely, (1) the change in ability to recall facts, knowledge, and principles as measured by a Dairy Enterprise Test, (2) the change in attitude toward farming as measured by an Attitude Toward Farming Scale, and (3) the ability to solve farm problems as measured by a Test in Solving Dairy Problems. The first two instruments were used as pre-tests and post-tests to obtain a measure of change, whereas the latter was given only at the end of the experiment.

Both mental and reading abilities for each pupil were determined, the former through the use of the California Capacity Questionnaire and the latter through the use of the Cooperative English Test C-1: Reading Comprehension. In order to control the influence these two abilities may have on pupil achievement, the data were treated by the statistical technique of analysis of covariance.

To sensitize the data, the pupils in the experiment were stratified according to various factors believed to have an influence on achievement. Data were collected from Agriculture II pupils, 91 taught according to the experimental pattern and 128 taught according to the conventional. A total of twenty-two teachers, eleven in each of the two patterns, taught four managerial units of instruction dealing with the dairy enterprise in accordance with plans prepared by the researchers.

In terms of the Dairy Enterprise Test, the general conclusion may be drawn that the experimental pattern of teaching was more effective than the conven-

tional in bringing about a change in ability to recall dairy information. In terms of the Attitude Toward Farming Scale and the Test in Solving Dairy Problems, there was no difference in effectiveness between the two patterns. In the case of a few of the stratifications treated, the general conclusion does not hold. These were discussed in the body of the report. Implications the findings may have for educators were also listed.

332 pages. \$4.15. MicA54-2991

ORGANIZATIONAL APPROACHES TO THE DEVELOPMENT OF COMMUNICATION COURSES IN COLLEGE PROGRAMS OF GENERAL EDUCATION

(Publication No. 9564)

Wilbur Irving Throssell, Ed. D.
University of Florida, 1954

The central problem of this study has been to determine whether or not college courses in communication may be characterized by the organizational approaches used and, if so, which organizational approaches might be most effective in achieving the stated objectives of communication courses in college programs of general education.

Procedures used were designed to analyze and categorize data to determine whether or not relationships exist between objectives and approaches.

The terminology was defined and illustrated through reference to occurrence among the institutions and through citation of recognized authority.

The data revealed few distinctions or differences which are sharp or conclusive. Rather, it can be said that trends and tendencies characterized the comparisons.

The most productive learning takes place within a framework of realistic general education which translates into the maximum development of communication skills among students according to needs, ability, obligations, and interests for creative, satisfying, and actively participating roles in a democratic society.

311 pages. \$3.89. MicA54-2990

A SURVEY OF PUBLIC RELATIONS PRACTICES IN LOCAL SCHOOL BUILDING PROGRAMS

(Publication No. 9203)

Garland Sayers Wollard, Ed. D.
University of Missouri, 1954

Major Adviser: W. W. Carpenter

Purpose: The major purpose of this study was to survey the public relations practices in local school building programs in Missouri.

Method of Research: An analysis was made of seventy-six newspapers published in selected school systems, that were available for study at the University of Missouri library. These newspapers were analyzed to determine the number of articles, the subjects of the articles, and the sources of authority for the articles concerning the school building programs carried on from August 1, 1949, to November 15, 1953. Personal interviews were made with twenty-four newspaper editors and thirty-two Missouri superintendents of schools. Check lists were developed that were used as a means of securing information concerning the public relations procedures relative to the school building programs.

Summary:

- (1) The total number of articles in the seventy-six newspapers concerning school building programs carried on from August 1, 1949, to November 15, 1953, was 3,443. Of these articles, 2,090 were concerned with existing building conditions and/or their future needs, 156 with number and/or size of classrooms, 386 with selection and/or cost of school building sites, and 811 with school district indebtedness and/or tax levies. Of the 3,443 articles, 1,105 originated in boards of education, 770 in Parent Teachers Associations, 561 in superintendents, and no sources were indicated in 512 articles. Paid advertisements were sources for 145 articles, letters to editors for 126, editors for 104, civic organizations for 102, and school news columns for only eighteen.
- (2) Newspapers published in city school districts ranked first in the number of articles with an average of 113.5 articles per newspaper, school districts voting disapproval of bonds ranked second with an average of seventy-two articles per newspaper, consolidated school districts ranked third with an average of forty and five-tenths articles per newspaper, and reorganized school districts ranked fourth with an average of twenty-seven per newspaper.
- (3) When the agents assisting in the school building programs in each type of school district were totaled, the city school districts ranked the highest with a total of seventy-four agents, or an average of nine and two-tenths per school; the reorganized school districts and the districts voting disapproval of bonds each ranked two and five-tenths, or next to the highest, with a total of sixty-four, or an average of eight per school; and the consolidated school districts ranked fourth with a total of sixty-two or an average of seven and seven-tenths per school.
- (4) When the agencies used to distribute information concerning the school building programs in each type of school district were totaled, the districts voting disapproval of bonds ranked highest with a total of sixty-two agencies, or an average of seven and seven-tenths per school; the consolidated school districts

ranked second, or next to the highest with a total of fifty-five, or an average of seven per school; the city school districts ranked third with a total of fifty-four, or an average of six and seven-tenths per school; and the reorganized school districts ranked fourth with a total of forty-five, or an average of five and six-tenths per school.

- (5) All the school districts included in this study held special elections for voting on bonds.
312 pages. \$3.90. MicA54-2992

**MAINTENANCE TRAINING METHODOLOGY
FOR AUTOMATION: THE DEVELOPMENT OF
METHODS AND TECHNIQUES WHICH MIGHT BE
UTILIZED TO ASSIST INDUSTRY IN TRAINING
MAINTENANCE MECHANICS TO SERVICE
COMPLICATED, CUSTOM-BUILT, SEMI-
AUTOMATIC OR FULLY AUTOMATIC MACHINES**

(Publication No. 9790)

Herbert George Zollitsch, Ph. D.
Cornell University, 1954

The Problem

The trend of automatic equipment into industry today presents a challenge to industrial educators. Some of the monster machines which are currently being created to raise society's standard of living may only achieve their objectives if they are kept in practically continuous operation. The purpose of this study was to gather data that would assist in providing answers to the following questions involving complicated, custom-built, semiautomatic and fully automatic machines:

1. What method of approach in training maintenance mechanics would keep equipment breakdown time to a minimum?
2. What methods can be effectively used to determine training requirements for servicing these machines?
3. What methods are effective in compiling and preparing instructional materials when there are none available?

Method of Research

A pilot study was conducted for over one year in a factory (1300 employees) pioneering in the development and full utilization of complicated, custom-built, semiautomatic and fully automatic machines. The chief investigation methods used in obtaining information were interviews and personal observation, with original research being performed at the plant level. A review of literature provided the past and present status of the problem.

Thesis Contents

The dissertation describes the following methods and techniques for assisting in the instruction of maintenance men to service the type machines likely to be used in automation:

1. How to select the machine on which to begin a maintenance educational program.

2. How to obtain equipment information when there is very little in printed form.

3. How to systematically analyze a machine to determine complete maintenance requirements.

4. How to analyze upkeep requirements to determine the training which will satisfy the needed maintenance.

5. How to compile and develop instructional materials in preparation for the training of service employees. Special emphasis was placed on the development of an operation and maintenance manual as a source of educational reference material.

In the development of the methods and techniques many obstacles were encountered. The thesis describes the experiences in overcoming them.

Major Findings

1. Equipment breakdown time is a matter of major concern today. In the plant studied, there were times when every minute of down time amounted to a loss equivalent to 240 workers being paid \$2.40 per hour for standing idle.

2. "Breakdown Maintenance," the traditional approach to machine upkeep, is inadequate for machinery used in automation because it fails to do anything to head off mechanical malfunctions.

3. The training of maintenance mechanics can no longer be left to chance, or be of the trial and error variety. If it is, the money lost in breakdown time

soon exceeds the costs of a planned instructional program. And there is nothing to show for such losses.

4. The purchaser of automation equipment will have to conduct maintenance training to protect his investment.

5. It is essential to have an operation and service manual available for instruction as soon as possible.

6. Analysis and record keeping procedures are becoming of greater importance in maintenance and its training.

Major Recommendations

1. Before setting up a program of instruction for machine repairmen, a company should ascertain that its system of maintenance is designed to emphasize the prevention of breakdowns as well as the repairing of them.

2. Managements should take positive steps to see that a planned maintenance training program is established as soon as a mechanical installation begins.

3. Companies should consider "Maintenance Teams" for servicing machine breakdowns.

4. Service employees and their facilities should be located in the immediate vicinity of the machine if it is to be quickly repaired.

5. Schools preparing mechanics and technicians should examine their curricula to determine whether future needs of maintenance are being considered.

267 pages. \$3.34. MicA54-2993

ENGINEERING

ENGINEERING, GENERAL

A FOLLOW-UP OF ENGINEERING DROP-OUTS, UNIVERSITY OF MISSOURI, 1947-1952

(Publication No. 7592)

Theodore Edgar Wiehe, Ed. D.
University of Missouri, 1954

Major Advisor: H. H. London

Purpose of Study: The purpose of the study was to make available information concerning the educational and occupational activities of the drop-outs of the Engineering College of the University of Missouri prior to, during, and after their attendance in the College of Engineering. Further, the study sought to obtain reasons for dropping out and opinions and suggestions for the improvement of the programs offered by the College of Engineering.

Sources of Data: Data for the study were obtained from the records in the Engineering Dean's Office and the Office of the Director of Admissions, and from information forms checked by 425 of 1,478 drop-outs of the College of Engineering. The data was tabulated by International Business Machines.

Summary: Two thousand six hundred and thirty-two students enrolled in the College of Engineering of the University of Missouri during the five year period with which this study was concerned, 1947-48 through 1951-52. Of this number, 1,478, or 56 per cent, dropped out before graduating.

The majority of the drop-outs graduated in high school classes of 200 or less. The mean percentile rank in high school was 40. The mean number of high school units earned in mathematics, chemistry, physics, and industrial arts were respectively, 3.68, 1.5, 1.5, and 2.05. Sixteen per cent of the drop-outs had held neither a part-time nor a full-time job before entering the Engineering College. The drop-outs had been employed most frequently in the "semi-skilled" occupations before entering the Engineering College.

More than one-half of the drop-outs chose engineering because they thought they had "an interest in this type of work." Less than 2 per cent of the drop-outs gave "advice of counselor" as a reason for selecting engineering. The mean age of the 425 drop-outs at the time of initial enrollment in engineering was 20.5 years. The mean number of semesters that the drop-outs completed in engineering was 2.98 semesters. The mean number of semester hours completed was 37.7, while the mean grade point average was 1.84. The

drop-outs, as students, worked an average of fifteen hours per week on jobs other than their engineering studies. Nearly one-half of the drop-outs did not participate in any extra-curricular activities. The mean number of hours devoted to extra-curricular activities by the group was 2.53. The mean intelligence (ACE) score of the drop-outs was 57.8.

The most frequent reason given for dropping out was "discouragement due to low grades." The most common reason given for changing to another occupation or for attending another Engineering College was "developed new interest." More than one-half of the drop-outs had attended some college or university since leaving the College of Engineering. The three most frequently occurring occupations in which the drop-outs had been employed were "protective service," "clerical and sales," and "semi-professional-industrial." The mean weekly wage that the drop-outs had received since dropping was \$69.00. One-third of the drop-outs were of the opinion that the engineering training should have "included more practical engineering problems." Of occupations requiring two years or less of training, "building and construction" was the one desired most frequently.

Apparently no significant relationship exists between the number of semesters completed in the Engineering College by drop-outs and percentile rank in high school, age at time of initial enrollment, size of high school graduating class, intelligence scores, or wages earned per week immediately after dropping out of engineering.

No significant correlations were found to exist between grade point average earned in engineering and percentile rank in high school, size of high school graduating class, intelligence scores, or wages earned per week after dropping out of engineering college. 146 pages. \$1.83. MicA54-2994

ENGINEERING, AERONAUTICAL

EFFECT OF SECONDARY STRESSES ON THE DYNAMIC CHARACTERISTICS OF AIRCRAFT STRUCTURES

(Publication No. 9335)

Richard John Holden Bollard, Ph. D.
Purdue University, 1954

Major Professor: Hsu Lo

A theoretical analysis of the effect of secondary stresses, arising from warping restraint, on the

principal frequencies of vibration of cantilever beams is presented herein. The system chosen for analysis is that of a cantilever beam of finite length, of monocoque construction, with or without corner stiffeners, of a trapezoidal cross-section and having a concentrated mass attached at some point along its length. It is shown that when the mass of the beam is negligible an exact analysis can be derived in terms of a secondary, self-equilibrating system which is formulated from an eigenvalue problem dependent upon the cross-section shape, the beam length and the concentrated mass location etc. A numerical example is given for a specific beam and compared with the fundamental frequency for the case of no warping restraint. The results indicate that the inclusion of the secondary stresses may increase the fundamental frequency by as much as forty five percent for the shallow beam chosen supporting the concentrated mass at a point twenty per cent of the span from the root.

The exact analysis shows that the mathematics and numerical calculations involved become unwieldy even for the simplest bending-torsion system with point application of loading. To overcome this restriction to simple systems, an approximate analysis, based on Hamilton's principle, is developed and the application is illustrated by consideration of several specific torsion and bending-torsion systems. It is shown that even for the most general bending-torsion system, that of a uniform monocoque tube of arbitrary cross-section shape, a general frequency equation may be readily obtained from which not only the fundamental but also the higher harmonics can be evaluated.

152 pages. \$1.90. MicA54-2995

ENGINEERING, CHEMICAL

THE PRODUCTION OF VINYL CHLORIDE IN A FLUIDIZED CATALYST BED

(Publication No. 9346)

Marlin George Geiger, Jr., Ph. D.
Purdue University, 1954

Major Professor: R. Norris Shreve

The process variables for the production of vinyl chloride monomer in a fluidized catalyst bed were studied over a wide range of conditions. The principle variables chosen and the ranges over which they were varied were temperature (100-140°C), feed rates (3-20 C.F.H.), feed ratios of acetylene to hydrogen chloride (1:1 - 3:1), and catalyst weights (1/2-2 pounds). The reactor consisted of a jacketed two inch iron pipe with appropriate auxiliary equipment and instruments. The catalyst was prepared by the Davison Chemical Corporation and consisted of 8-10 percent mercuric chloride suspended on an activated carbon carrier. Fluidization and attrition characteristics were determined in a separate glass unit.

Conversions based on hydrogen chloride ranged from 15 to 100 percent while those based on acetylene ran from 10 to 84 percent. The data were collected and analyzed on a statistical basis using a factorial design for the experiments and then applying an analysis of variance technique to the results. This indicated that all four basic variables mentioned above were highly significant individually although the interactions were insignificant.

91 pages. \$1.14. MicA54-2996

KINETICS OF PROCESSING ASPHALTIC RESIDUES

(Publication No. 9549)

John Daniel Holmgren, Ph. D.
University of Florida, 1954

In this study a general rate equation was developed for the reaction rate of blowing asphalt residues with air and oxygen enriched air. Both batch and continuous operations were used in this asphalt blowing process. The rate of reaction was measured as the rate of change of asphalt Ring and Ball softening point and related to the following process variables: feed gas flow rate, feed gas oxygen concentration, product consistency and a pseudo reaction velocity constant. The effect of reaction temperature was a function of this pseudo reaction velocity constant. The capacity of the asphalt reactor was 20 pounds of asphalt, and the reactor was agitated with a laboratory Turbo-Mixer agitator. The four Texas asphalts that were used represented four different types having substantially different properties. The degree of variation of the process variables was: feed gas flow rate, 25-100 ft.³/min.-ton asphalt; feed gas oxygen concentration, 21-50 per cent; and reactor temperature, 450-550° F. The extent of oxygen utilization was determined for all the reacting asphalts and related to the change in asphalt consistency. The fume oil products in the reacted gas stream, such as, water vapor, oil smoke and entrainment mist, were precipitated in a Cottrell electrostatic precipitator. A sample calculation was presented to illustrate the use of the general rate equation for scale up procedures in the design of industrial asphalt processing equipment.

127 pages. \$1.59. MicA54-2997

MECHANISM OF WOOD PULPING BY THE KRAFT PROCESS

(Publication No. 9550)

Ghananeel R. Kulkarni, Ph. D.
University of Florida, 1954

The purpose of the investigation is to study the physical mechanism of wood pulping by the Kraft Process. The individual effects of cooking temperature, cooking time and cooking liquor concentration

on the rate of delignification have been evaluated. The cooking temperature and the liquor concentration are maintained constant during the course of a cook. Large blocks of wood have been cooked and analyzed for sulphide, active alkali, combined alkali and lignin at different cross-sections in order to follow the progress of the delignification reaction into the interior of the block. Color photo-micrographs are taken to substantiate the results of chemical analysis.

It has been found that the delignification reaction follows the mono-molecular law except for the last 3% lignin in the wood. The velocity constant of the reaction has been shown to vary with temperature in accordance with the Arrhenius equation. It has also been shown to be a linear function of liquor concentration. A mathematical relationship showing the effects of the three variables on the delignification has been developed. This equation has been found to be theoretically applicable to the delignification data of other workers.

The study with the large blocks indicates that both the diffusion of the alkali into the wood and the chemical reaction between alkali and lignin are the rate governing factors. The organic products of the reaction, although their diffusion rates are slow, do not appear to have any effect on the rate of delignification, indicating that the reaction between alkali and lignin is not an equilibrium reaction. The chemical analysis of different cross-sections of the cooked block, as well as the photo-micrographs indicate that there is a definite region of demarkation between the delignified portion and the rest of the wood block. In this narrow region the lignin removal appears to vary from almost no delignification to practically complete delignification. 108 pages. \$1.35. MicA54-2998

KINETICS OF SULFONATION REACTIONS

(Publication No. 9798)

Gerald Alfred Ratcliff, Ph. D.
Cornell University, 1954

The kinetics of sulfonation of benzene by sulfur trioxide in dichlorethane solution were measured at 25°C. The reaction is very rapid and is complex. The kinetics were studied by measuring the initial rate of the reaction. A continuous flow method was used to obtain the short reaction times required. Results were:

$$-\frac{dC_i}{dt} = 5.11 C_{H_i}^{0.57} C_{S_i}^{1.24}$$

where C_{H_i} = initial concentration of benzene, gram-moles per liter

and C_{S_i} = initial concentration of SO_3 , gram-moles per liter.

Exploratory runs were made with toluene. The reaction is much faster than the sulfonation of benzene. 165 pages. \$2.06. MicA54-2999

A STUDY OF THE BONDING BY AIR-SETTING REFRACTORY MORTAR AT ELEVATED TEMPERATURES

(Publication No. 7588)

Bhikhubhai Mahadeo Sedalia, Ph. D.
University of Missouri, 1954

Before and just after the turn of the century, clay had been the principle bonding material used for laying bricks in furnace construction work. Because of its high drying shrinkage and very low bonding strength below the sintering temperatures, much investigation has been carried out on the development of suitable refractory mortars for use in present day industrial furnace. An extensive review of such investigations, reported up to this date, has been presented. Review of other literature on essential properties and requirements of a refractory mortar has also been given.

Bonding ability has been considered the most important property of the mortar. Several methods have been reported for evaluating this property among which the A.S.T.M. method has been usually followed. By this method cold modulus of rupture on jointed bricks is determined after previous drying or firing at several temperatures. Such results give information regarding room temperature strength of fired joints. Since mortar joints are expected to be mechanically stable at furnace temperature, the knowledge of bonding ability of mortar at elevated temperatures is very essential. With this view in mind the present investigation was undertaken.

During this investigation an attempt has been made to determine the modulus of rupture of the joints and thereby the bonding ability of mortar, at elevated temperatures. Also a study has been made concurrently on the influence of several variables of the batch on the bonding ability of the mortar. Several batches have been compounded by varying the amount of grog, grain size of grog, amount of plastic clay and amount of bonding agent, for this study. Because of its most common use, air-setting refractory mortar of wet type has been preferred and therefore wet N-brand sodium silicate is used as the bonding agent.

A special furnace having an independent system of loading mechanism has been constructed for the determination of hot modulus of rupture. Five determinations can be made at a time at one temperature. Hot modulus of rupture is determined on joints prepared of compounded batches at temperatures 100°, 200°, 400°, 600°, 800°, 1000°, 1100°, 1200°, 1300° and 1400°C.

High, initial bonding strength slowly decreases on raising the temperature and reaches a low value at 600°C. On further heating, the strength of the joint slowly rises, reaching a maximum value at 1200°C. Strength is again lost at 1300°C and is very low at 1400°C. A similar trend is approximately observed for all the compounded batches. Batches with initial high dry strength, did not lose strength appreciably at 600°C, while batches initially weak did not show a

substantial increase even at 1200°C. All joints are weakest at 1400°C.

A gradual loss of water from sodium silicate is the cause attributed to loss of strength up to 600°C. The low value at 600°C is the result of a complete loss of water from the silicate, a loss of combined water from the plastic clay, expansion of the mortar body in the joint and softening of the dry silicate in the batch. Rise in strength at 800°C is due to a glueing action of the viscous liquid silicate on the brick surface and on the grog grains in the mortar. At 1000° and 1100°C an increase in strength is due to the presence of more viscous liquid and also the initial growth of mullite crystals. The sudden increase in a maximum strength at 1200°C is caused by the rapid growth of mullite crystals interlocking at the interface of the mortar and brick surface as well as within the mortar body. Due to the presence of higher amounts of liquid and low viscosity, the strength is reduced at 1300°C and reduces further to a very low value for the very same reason.

All variables of a batch collectively affect the batch and it is difficult to single out the influence of individual variable. However, the following generalization can be made. Larger amounts of sodium silicate increases the bonding ability of the mortar. A large ratio of coarse grain size material in the batch produces stronger joints. Combination of high silicate and high coarse grain ratio in the batch gives the strongest joints. High silicate with more fine grain ratio or low silicate with more coarse grain ratio gives a bonding strength of the same order, though a combination of coarse grain with low silicate is slightly better. Very high ratio of finer grains in the batch, irrespective of the amount of silicate gave bonds of very low strength.

Plastic clay content does not affect the strength too much unless a very high or very low amount is present. Higher amounts result in excessive drying shrinkage and low strength while lower clay content produces lean mortar with low workability. The water content of a batch varies along with other variables and hence is difficult to consider individually. However, higher water content in a batch tends to weaken the bonding strength. Low water content, just enough for satisfactory workability, is most desirable for preparing thin and strong joints.

227 pages. \$2.84. MicA54-3000

APPLICATIONS OF EVAPORATED METAL FILMS

(Publication No. 9780)

Theodore B. Simpson, Ph. D.
Cornell University, 1954

A number of types of evaporated metal films 400 to 3000Å thick deposited on glass surfaces have been developed showing usefulness as thermosensitive elements in air over ranges of temperature and periods of time far exceeding those previously offered. Nickel and cobalt films showed high sensitivity with

usefulness at temperatures up to 300°C as well as outstanding stability. Chromium, titanium, tantalum, gold, vanadium, and chromium over nickel films proved useful to intermediately high temperatures. Platinum and molybdenum disilicide films show promise of being suitable with further development at even higher temperatures. These films may displace conventional devices lacking versatility and reliability.

The films have been evaluated in three typical hot liquids, organic, weakly ionic, and strongly ionic in nature, to permit predictions of their behavior as thermometers in other media. Tests of their abrasion resistance indicate that suitably selected films should be rugged enough for service in most liquids and in gentle contact with solids.

Tests of the corrosion rate of the films of the above metals and tungsten, molybdenum, and zirconium have been made to demonstrate their desirability as corrosion resistant films to protect massive objects with metals whose cost would otherwise be prohibitive. Titanium and chromium show complete corrosion resistance to most of the common acids at room temperature and inertness far superior to that of the bulk metal. The remaining metals in general have corrosion resistance at least equal to that of the massive metal.

Films have been formed having temperature coefficients of resistance approaching zero. These films would be exceptionally suitable as precision resistors for use over wider ranges of temperature than is generally possible. Chromium films in most thicknesses with very small maximum temperature coefficients and flexed curves of resistance vs temperature may be produced by special techniques. Films of vanadium or of mixtures of metals having very small linear coefficients may be formed.

In some respects the conditions and methods of evaporation of the metals in high vacuum were unusual. Deposition of metal on a substrate at 200°C proved strikingly effective in producing films of superior adherence and stability and electrical properties closer to those of the bulk metal. Evaporation of nickel and cobalt from thorium oxide crucibles resulted in highly desirable films, and the technique of electron bombardment permitted what may be the first evaluation of the electrical properties in thick films of the refractories, molybdenum, tungsten, and tantalum. Larger quantities of metals were evaporated than is the custom.

Various of the techniques developed were of unusual interest. The constant temperature bath used for the calibration of the films was controlled by a highly satisfactory resistance thermometer in Wheatstone bridge circuit whose unbalance was relayed to phototubes by a reflecting galvanometer. Regular control at specified points was made convenient.

Highly satisfactory soldered contacts direct to evaporated films of chromium, nickel, cobalt, and molybdenum disilicide were prepared. These permit convenient low resistance contacts to films.

The work produces indications of the causes of some of the unique properties of thin films. Contamination by refractory metal from the heater appeared to result in high film resistivities and adherent

thicknesses. Closer approach of evaporated alloys to the properties of the bulk alloy point to lattice disorder as the common cause of high resistivities. A correlation of the deviation of the temperature coefficients of the transition metals from bulk values with atomic number further indicates a relation between the electrical conduction disturbances and atomic structure and points to greater independence of the atoms and their electrons than is true in the bulk metal. 201 pages. \$2.51. MicA54-3001

THE RATE AND MECHANISM OF DRYING FOR WHEAT MIDDLING PARTICLES

(Publication No. 10,042)

Gino Sovran, Ph. D.
University of Minnesota, 1954

The control of moisture content is very important to the grain processing industry, since the moisture content of their products is a determining factor in storage life and on the profit margin resulting from their processing. The purpose of this investigation was to obtain fundamental information on the moisture changes of wheat middling particles.

Although this investigation was specifically concerned with the drying characteristics of wheat middling particles, the results obtained and the method employed have a wide range of applicability. The experimental technique developed can be used for studying the drying of any hygroscopic material that occurs in small particle form. Information on individual particles can be obtained and the results should be similar to those obtained here. In addition, the weighing and recording system can be used in investigations on the evaporation rates of drops of various liquids under approximately free convection conditions.

A torsion balance was constructed that could measure the weight of a drying sample continuously while it underwent very small and rapid changes in weight. A photographic system incorporated into the balance gave a permanent record of the sample weight as a function of time. Samples of approximately 200 milligrams were used that underwent weight changes of 10 to 15 milligrams. Seventy-five percent of this change could occur in about 3 minutes. The sensitivity of the balance could be adjusted so that any weight change would give a full scale deflection. For the greatest sensitivity used in these investigations a weight change of 1 milligram caused a scale deflection of 30 millimeters. Much greater sensitivities could have been attained for the balance. The torsion balance gave only relative weights of the sample. Absolute weights were obtained by means of an analytical balance. The torsion balance was built into the case of this balance and an exchange mechanism was constructed to quickly switch the screen on which the material rested from one balance to the other.

A moisture mechanism was designed that would supply a high humidity atmosphere around a sample

being prepared for drying and that could then be very quickly removed from about the sample, exposing it to a lower humidity atmosphere in which it could dry. This essentially instantaneous change in humidity about the sample was necessary because of the magnitude of the drying rates at the beginning of a run and the short length of the drying runs.

A pure strain of wheat middlings was separated into nominal sieve fractions of 149-177, 210-250 and 297-350 microns and investigated under isothermal drying conditions of 25 and 50°C. The particles were dispersed on a 325 mesh phosphor bronze screen so that the particles were essentially isolated from each other. The material was dried from an initial moisture content of 17 percent on a dry basis down to final moisture contents as low as 7 percent. The effects of air humidity, air velocity, particle size and temperature were studied.

When the drying rates per pound of dry solid were plotted against time on log-log coordinates, curves that were very nearly straight resulted in all but the initial portion of the curve. When the unaccomplished free moisture change or free water ratio was plotted against time on log-log coordinates, curves that were essentially straight resulted. The drying runs were usually carried to free water ratios of about 0.15.

The consideration of vapor pressure as the driving force causing drying gave an explanation of the temperature effect on drying rates that was more logical than that when concentration was considered as the driving force.

145 pages. \$1.81. MicA54-3002

AN OXIDE PROCESS FOR METALLIC CALCIUM

(Publication No. 9200)

Walter Dennis Threadgill, Ph. D.
University of Missouri, 1954

Experiments were made to determine if metallic calcium could be obtained by electrolyzing calcium oxide dissolved in molten calcium chloride, and to obtain data indicating whether such a process might offer some advantages over the regular commercial electrolysis of the chloride itself. For comparison, control electrolyses of the chloride were made. Also, related investigations of solubilities and freezing points for the calcium oxide-calcium chloride system, and rates of hydrolysis of molten calcium chloride were made.

Small cells similar to the usual commercial units of today and to those employed in some published investigations of the chloride electrolysis were used. The electrolyte containers were machined from graphite electrodes and graphite anodes were used. A water-cooled, retractable, contact cathode was used and the metal was continuously drawn from the bath as a solid "carrot" kept in contact at its lower end with the electrolyte.

Calcium oxide concentration in the electrolyte was determined by dissolving a weighed sample in standard hydrochloric acid and titrating the excess acid

with standard sodium hydroxide. Oxide content of the electrolyte decreased due to electrolysis, and tests showed that chlorine was not released at the anode.

Carrots of metallic calcium were readily obtained by electrolysis of solutions of up to 2% calcium oxide in calcium chloride. With concentrations between 2% and approximately 14% oxide, the bath was so fluid that the metal carrot could not be protected with a film of frozen electrolyte as it emerged from the electrolyte and the metal burned. Convection currents were also particularly troublesome in this concentration range.

This appears to be the first demonstration that calcium oxide can be fed to a chloride electrolyte for calcium production. No pastiness of the electrolyte was in evidence except at high oxide concentrations, approximately 14% and above.

The most favorable temperature range for electrolysis of the oxide-bearing electrolyte from the standpoint of ease of control and good carrot formation was 788° C. to 816° C. The most favorable oxide concentration range from the same standpoint was 0.5% to 1%, but satisfactory operation was obtained with concentrations up to 2%.

Average cell voltage with the oxide-bearing electrolyte ranged up to 23.9% less than that with the chloride alone. A large cell and large anode surface area were advantageous in both lower average cell voltage and ease of operation and control. Anode effect presented no problem with the oxide-bearing electrolyte, in contrast with the chloride electrolyte.

Metallic calcium content of the electrolyte was determined by use of a volumetric procedure devised to measure the volume of hydrogen liberated when the metal reacted with water. Metal content of the electrolyte was less with the oxide-bearing electrolyte than with the chloride alone. The average value for the chloride alone was 0.0328% as compared to 0.0211% for the chloride-oxide electrolyte. These values are substantially below those reported by previous investigators.

Molten anhydrous calcium chloride undergoes hydrolysis when in contact with air. A melt, covered with a loose fitting lid, exhibited an oxide concentration of 0.59% at the end of fifty-two hours.

Addition of calcium oxide to calcium chloride reduces the freezing temperature to a minimum at 593.3° C. with an oxide concentration of 16.88%. This investigation indicates the existence of an eutectic mixture with the above composition and freezing point.

115 pages. \$1.44. MicA54-3003

PART ONE: RELATION OF COMPOSITION TO VISCOSITY AND SURFACE TENSION OF THE ENAMEL GLASSES.

PART TWO: RELATION OF VISCOSITY, NUCLEI FORMATION, AND CRYSTAL GROWTH IN TITANIA-OPACIFIED ENAMEL.

(Publication No. 9167)

Tin Boo Yee, Ph. D.
University of Illinois, 1954

Part One

Relation of Composition to Viscosity and Surface Tension of the Enamel Glasses

Introduction

The smoothness of the enamel surface and the workability of the enamel are influenced by both viscosity and surface tension of the enamel. The published literature pertaining to absolute viscosity and surface tension measurement on enamel is quite meager.

Experimental Methods

The measurement of viscosity was done by an oscillating-cylinder type viscosimeter, and the measurement of surface tension was done by the maximum bubble-pressure method. Frits of ground coat compositions and of titania-opacified enamels were studied.

Results

Calcium fluoride lowers the viscosity of the ground coat frit. The first few percent are usually more effective than further additions. More than about eleven percent of calcium fluoride resulted in crystallization.

The solution of iron oxide in the enamel lowered the viscosity of the enamel frit very little. Over thirteen percent of iron oxide in the enamel caused crystallization in the melt.

Blends of hard and soft frits have viscosities in proportion to the viscosities and relative amount of the frits blends.

Cobalt oxide, nickel oxide, and manganese dioxide added to enamel frit produced only minor increase in viscosity.

Titanium dioxide lowers the viscosity of the enamel frit, but over eleven percent of titanium dioxide in the enamel frit caused crystallization in the melt.

Small amounts of ammonium molybdate decreased the viscosity of the enamel slightly, but small amounts of iron and nickel sulfates in the enamel caused minor increase in viscosity.

Temperature and composition did not influence surface tension of enamels greatly.

Part Two

ENGINEERING, CIVIL

Relation of Viscosity, Nuclei Formation, and
Crystal Growth in Titania-Opacified EnamelIntroduction

Since the excellent covering power and reflectance of titanium enamels are the result of formation of minute crystals of titanium dioxide as anatase and rutile during the firing and cooling of the enamel, this research on the relationship of viscosity, nuclei formation, and crystal growth was undertaken.

Experimental Methods

The methods used in this investigation were the measurement of viscosity, X-ray analysis, differential thermal analysis, and the study by light microscopy and electron microscopy of very thin heat treated films which had been produced by blowing bubbles from a high temperature melts.

Results

The investigation shows that there is a relationship between viscosity, number of nuclei, and crystal growth during the firing of titania-opacified enamels. This agrees with the similar relationship that Tammann found in his experiments with organic and inorganic glasses.

The size of the crystals formed in the heat treated films between 720° and 750°C. was about one tenth of a micron. At 775°C. the size was about two to three tenths of a micron. The maximum size at 800°C. was about one and one half microns. Further increase of temperature caused some crystals to group themselves together to form clusters.

X-ray analysis shows that these crystals at 740°C. were anatase, and at 800°C. they were both anatase and rutile. Electron micrographs show that crystals below 800°C. appeared to be rounded particles, and above 800°C., the crystals appeared to be irregular, oblong and long particles.

As the temperature increases from 700° to 1100°C. the color of the samples viewed under reflected light changed from light blue to white and then to cream white.

140 pages. \$1.75. MicA54-3004

NUMERICAL DETERMINATION OF
INFLUENCE COEFFICIENTS FOR
MOMENTS IN SKEW I-BEAM BRIDGES

(Publication No. 9051)

Tien You Chen, Ph. D.
University of Illinois, 1954

The type of structure considered in this thesis is a simple-span skew bridge, which consists of a concrete slab supported by five identical steel beams, uniformly spaced and parallel to the direction of traffic. Because of the complicated nature of the boundary conditions involved in the problem, no exact solution, so far as known, has been available. In this study, the numerical method of finite differences was used.

Difference equations are developed for a general system of skew coordinates to permit the analyses of the structures for any angle of skew, ratio of the spacing of beams to the span, and any relative stiffness of the beams.

Using a network of points, chosen primarily by consideration of the limiting capacity of the ILLIAC electronic digital computer in the solution of simultaneous equations, influence coefficients are obtained for moments in the slab and in the beams for 18 simple-span skew bridges, of various proportions of the spacing of beams to the span, and different angles of skew. The flexibility of the beams is taken into account in the analyses.

The results obtained by the difference equations are approximate. In order to test the degree of approximation of the results, difference analyses of a group of right I-beam bridges, of which exact solutions are available, are made, and the influence values so obtained for the various effects in the bridges are compared with the corresponding exact values. Based on these comparisons, conclusions are drawn regarding the accuracy of the difference solutions, and the nature and amount of the corrections, where needed, to be applied to the approximate results. These corrections are applied, with some modification, to the influence values determined for the skew bridges, wherever errors are believed to exist. It has been found that only for influence values for moments in the slab are such corrections needed, for certain load positions; for influence coefficients for moments in the beams, the values obtained from the difference equations are accurate enough without corrections.

It is believed that the tabulated values of the influence coefficients given in the thesis are free of serious errors, and are sufficiently accurate for practical design purposes. From these values, influence surfaces in the form of contour maps are shown for several of the 18 structures considered. In conclusion, some general remarks are advanced, in a qualitative way, regarding the effect of skew on the behavior of I-beam bridges.

165 pages. \$2.06. MicA54-3005

EFFECTS OF AGGREGATE SHAPE ON THE STABILITY OF BITUMINOUS MIXES

(Publication No. 9331)

Moreland Herrin, Ph. D.
Purdue University, 1954

Major Professor: W. H. Goetz

A laboratory study was made of the effects of variations in aggregate shape, both coarse and fine aggregate, on the stability of bituminous-aggregate mixtures. The object of this study was not only to investigate the strength-characteristics of bituminous mixes as the shape of the aggregate was varied, but also to obtain a better understanding of the various basic factors that produced these changes in mixture strength.

Three variables were used in this study: namely, shape of the coarse aggregate, shape of the fine aggregate, and aggregate grading. Variation in the coarse aggregate shape was obtained by using angular crushed limestone, round uncrushed gravel, and crushed gravel. Round natural sand and angular crushed limestone provided the contrast in the shape of the fine aggregate. In order to investigate the influence of crushed gravel on the strength of bituminous-aggregate mixtures, several combinations of crushed and uncrushed gravel were used also. The differently shaped aggregates were combined in three representative gradings referred to as dense, open, and one-size and incorporated into bituminous mixtures. All of the bituminous mixes tested were hot mixtures in which an asphalt cement (60-70 penetration) was used. The asphalt content of each mixture was either that determined by the Corps of Engineers' design procedure or that normally used by the State Highway Department of Indiana. The asphalt content was kept constant for each grading and for each type of fine aggregate except for a limited series of tests.

The triaxial compression test was selected for measuring the stability of these bituminous-aggregate mixtures. This rational test method appeared to provide the most fundamental basis for the analysis of the various factors which contribute to the stability of bituminous-aggregate mixtures. Accordingly, triaxial specimens with varying percentages of crushed coarse aggregate and different fine aggregates were molded by the double-plunger compaction method. These specimens were tested in triaxial compression apparatus at different confining pressures. Resulting data were evaluated in terms of Mohr's theory of strength, assuming a straight-line Mohr's rupture envelope.

The results of this study indicated that, regardless of the type of fine aggregate, the influence of an increase in the amount of crushed gravel in the coarse aggregate fraction on the strength of the bituminous-aggregate mixtures tested varied with the type of grading; the effect on strength tended to become less as the grading of the mixture became denser. The strengths of the mixtures made from the one-size grading were materially increased as the percentage of crushed gravel in the coarse

aggregate was increased, while the strength of dense- and open-graded mixtures was affected little or none at all by varying the crushed gravel content. The strengths of all these graded mixtures could be increased, though, by changing the type of coarse aggregate from round gravel to crushed limestone. Moreover, a larger increase in the strengths of the dense- and open-graded mixtures was obtained by changing the type of fine aggregate from a natural sand to a crushed-stone sand than could be obtained by increasing the angularity of the coarse aggregate from round gravel to crushed limestone.

It is thought that the increase in the strength of the one-size bituminous-aggregate mixtures, produced by increasing the angularity of the aggregate, is due to greater frictional resistance and interlocking of the aggregate. In the densely graded mixtures, the increase in the strength that is produced by changing the shape of the aggregate is apparently due to an increase in the contact area of the binder film between the individual pieces of aggregate. For bituminous mixes with gradings somewhere between the two extremes of one-size and densely graded mixtures, both the frictional resistance and the amount of contact area of binder film seemingly affect the compressive strength as the shape of the aggregate is changed.

It must be kept in mind that this investigation was solely a laboratory study using only the triaxial compression test and Mohr's theory of strength for obtaining and analyzing the strength data. The test results have not been verified by other tests nor correlated with field performance of the mixtures involved. 142 pages. \$1.78. MicA54-3006

A NUMERICAL PROCEDURE FOR THE ANALYSIS OF HIPPED-PLATE STRUCTURES

(Publication No. 9166)

George Shaochih Wu, Ph. D.
University of Illinois, 1954

The object of this investigation is to establish a numerical procedure for the analysis of hipped-plate structures which are formed by medium thick plate elements, connected side by side along their longitudinal edges and simply supported on opposite ends. The procedure is applicable to all structures of its kind having constant cross-sections of polygonal shape, either open or closed, whatever the dimensions of the plate elements. The exterior longitudinal edges of the structure may be free, simply supported, or restrained in some other manner. This method of analysis is based on a trigonometric series solution of the problem. All common types of static loading are considered.

The fundamental basis of the procedure is derived from the moment-distribution method of analysis developed by Prof. Hardy Cross. In the consideration of the flexural action of the plates the distribution procedure for continuous slabs which was developed by Dr. N. M. Newmark is adopted. In the treatment

of plane stress problem the component of the edge reactions in the planes of the adjacent plates together with the corresponding component of external loads at a joint are considered to be carried by the structure through plane stress action of the plates. The longitudinal normal stresses at adjoining edges of the adjacent plates are balanced through a distribution procedure by introducing edge shearing stresses. Plane stresses and displacement components of the plates are determined from the theory of elasticity. The joint displacements which result from the plane stress solution are determined by equilibrium equations. In general, m (m denotes number of panels in the structure.) simultaneous algebraic equations are required to solve for the m unknown quantities. However, for structures with symmetrical cross-section under symmetrical loadings, only $(m-1)/2$ equations are necessary for odd numbers of panels and $m/2$ equations are required for even numbers of panels in the structure.

The resultant effect for a given load function is the sum of the effects due to each component of the series expansion of the loading function. The distribution procedure for each term of the loading series generally converges more rapidly than in the corresponding case in the continuous beam, and the procedure usually need only be carried out for a few terms in order to obtain the effect of the total loading. With the moments and deflections at the adjoining edges known, the effects in the interior of each plate can be determined. 107 pages. \$1.34. MicA54-3007

ENGINEERING, ELECTRICAL

AN INVESTIGATION OF THE DIRECTION OF ARRIVAL OF RADIO WAVES

(Publication No. 9032)

Albert David Bailey, Ph. D.
University of Illinois, 1954

A theoretical and experimental investigation was made of the direction of arrival of high frequency radio waves. Emphasis was placed upon the application of probability theory and statistics to known and proposed methods for improving the accuracy of the measurement of the direction of the wave source and decreasing the time required for such measurement. Means for reduction of the wave interference error was a specific goal.

Wave interference error due to multipath propagation is a significant contributor to the total standard deviation of the indicated bearing. It was shown from theoretical considerations that provided the probability distribution for the time phase of each of several interfering rays is uniform, the long-time mean error due to wave interference approaches zero. Also assuming that the wave polarization is random, the corresponding long-time mean error due to polarization approaches zero.

In order to investigate and experimentally verify the theoretical implications, an electronic bearing data computer and recorder was engineered. The computer-recorder samples the directional information data from a twin-channel cathode-ray type direction finder twenty-five times per second, computes the indicated bearing, and records the bearing and the signal amplitude on 35 millimeter film.

Experimental studies were made of the indicated bearings during those times of the day and year when wave interference effects would be most likely. Observations were made at Savoy, Illinois, on 6.42 mc/s propagations from Columbus, Ohio, and 5.0 mc/s propagation from WWV, Beltsville, Maryland.

The progressive or cumulative mean of the indicated bearings was considered the most significant of the several statistics that were calculated. The few isolated non-conforming cases are probably examples of lateral deviation effects. The improvement in accuracy due to time averaging over all data may be inferred from the following standard deviations of the indicated cumulative mean.

Averaging Time	Standard Deviation of the Cumulative Mean
14 seconds	1.4°
1 minute	1.0°
2 minutes	0.7°
3 minutes	0.5°
4 minutes	0.4°

Censoring schemes that are premised upon using a strong signal or a strong and steady signal as a criterion for "good bearings" will generally yield an improvement in accuracy of the indicated bearing. However, the results of this investigation demonstrated that the cumulative mean of all bearings is the best estimate of the great circle bearing. Central-limit theorem behavior was exhibited in more than 95 percent of all cases studied.

162 pages. \$2.03. MicA54-3008

APPROXIMATION METHODS IN NETWORK SYNTHESIS

(Publication No. 10,061)

Norman Balabanian, Ph. D.
Syracuse University, 1954

The problem dealt with in this dissertation may be stated as follows: Given an arbitrary function of frequency which is to be the gain or magnitude function of a network, to find a rational function of frequency which approximates this prescribed function to within prescribed tolerances while at the same time being a physically realizable network gain or magnitude function.

This dissertation makes two contributions to the above problem. Darlington's method of Tchebyscheff polynomial series, which applies to problems in the low pass plane or to problems in the band pass plane when the prescribed function has geometrical

symmetry, has been modified and extended to the case of band pass gain functions of arbitrary shape. This is done by finding a transformation which transforms the pass band on the $j\omega$ axis of the s plane to the central region of the real axis of a new complex plane. A subsequent transformation maps this region onto the unit circle in the z plane. The transformations are

$$\zeta = As^2 + B \quad \text{and} \quad \zeta = \frac{1}{2} \left(z + \frac{1}{z} \right)$$

where A and B are constants that involve the band edges, and $\zeta = \xi + j\eta$ and $z = e^{u+jv}$. The first transformation maps the pass band on the $j\omega$ axis onto the range $-1 \leq \xi \leq 1$ while the second one maps this latter range onto the unit circle in the z plane. The approximation procedure is to use these transformations to change a given function of ω into a periodic function in v ; then expand this function in a complex Fourier series which can then be written as a series in positive and negative powers in z . Darlington's procedure may now be applied to find the poles and zeros of the transfer function in the z plane. Use of the transformations will then give the poles and zeros in the s plane.

For a magnitude function which goes to zero (or to a small value) at the band edges, the gain function (being the logarithm of the magnitude) will go to negative infinity (or to a large negative value) at these points. Even if the Fourier series used in the approximation procedure converges, it will converge very slowly so that a large number of terms will be needed to provide an adequate approximation. Since the complexity of the resulting network will depend on the number of terms in the series, this will lead to an unduly complicated network.

With this in mind an approximation method using the magnitude function rather than the gain function was developed. The same transformations are used to transform a given function of ω into a periodic function in v . A Fourier cosine series in the real form is now written and a finite number of terms retained. This is changed to a polynomial in $\cos v$ by trigonometric identities which now becomes a polynomial in ξ by the second of the above transformations. A rational function in ξ is now found approximating the polynomial. The s plane poles and zeros are then obtained from the first of the above transformations.

This general approximation procedure was extended to the case in which a magnitude function is prescribed over the entire $j\omega$ axis. A well known transformation maps the entire $j\omega$ axis onto the unit circle in the z plane. Use of this transformation changes an arbitrarily prescribed function of ω into a periodic function in v , and following the method above this is approximated by a polynomial in ξ . The rational function is found as above.

Finally, the method using the magnitude function can be employed in the case of a low pass problem or a geometrically symmetrical band pass problem.

57 pages. \$1.00. MicA54-3009

THE FADING OF IONOSPHERIC SIGNALS

(Publication No. 9747)

Walter Aloysius Flood, Jr., Ph. D.
Cornell University, 1954

Amplitude distributions of vertical as well as oblique incidence ionospherically propagated signals were obtained in Ithaca, New York, during both quiet and disturbed periods in the ionosphere. These distributions were based on records of two minutes duration and were obtained at carrier frequencies in the range from two to five megacycles per second. In addition, the fading frequency spectra of such signals were also measured using autocorrelation techniques.

During quiet periods in the ionosphere, approximately 60% of the E region vertical incidence signals were essentially Rayleigh distributed. This is interpreted as indicating that during these times scatter is the most predominant mode of propagation. Oblique incidence distributions taken under the same conditions were Rayleigh distributed less than 40% of the time.

The theory of scattering which is used to explain the amplitude distributions must account not only for the large percentage of Rayleigh distributed signals at vertical incidence, but must also explain the pronounced dependence of the amount of scatter upon the angle of incidence to the ionosphere. It is shown that the Herlofson theory of scattering by plasma resonances is satisfactory in both respects while the Booker Gordon theory of scattering by turbulence, modified for the ionosphere, fails on both counts. It is further suggested that the classical theory of magneto-ionic propagation in a slowly varying horizontally stratified ionosphere serves to define the level at which the scattering takes place.

There are, however, experimental data taken at frequencies far in excess of the critical frequencies of the ionospheric layers. These data can be explained by the Booker Gordon theory. For the frequencies in question, there is little possibility that plasma resonances may be excited. It is suggested, therefore, that in general two types of scattering mechanisms are present in the ionosphere: Herlofson scattering by plasma resonances and scattering by turbulence in the Booker Gordon manner. If one is concerned with frequencies in excess of the maximum plasma frequency of an ionospheric layer, then Booker Gordon theory is probably the correct theory to use. On the other hand, if the radiated frequency is less than the maximum plasma frequency in the layer, plasma resonances would probably mask the effect of scattering by turbulence and the Herlofson theory is the correct one to use.

Amplitude distributions taken during disturbed or auroral periods show a much increased percentage of scatter. For vertical incidence, some 80% of the records are Rayleigh distributed. Moreover, whereas during quiet periods, fading rates of vertical incidence signals average around one half cycle per second, during auroral periods the fading rates are increased by a factor of ten. The average fading rate

during these periods is approximately 4-5 cycles per second at a carrier frequency of 2.4 megacycles. There is some indication that the fading rate of signals during such periods is directly proportional to the carrier frequency used.

Details of the auroral ionosphere as seen at Ithaca, New York, are also given along with the correlation of HF echoes with VHF CW and radar auroral echoes.

A theory for an explanation of the spread F phenomenon during non-auroral periods is advanced. This theory would relate the spread in virtual height and critical frequency with the size of Booker Gordon blobs in the nighttime E region. It is shown that with the range in blob sizes (correlation distances) reported for the E region, one can go from a non-spread fine trace condition to a completely spread F region.

The mathematical theory for the density function for the resultant of N components and scatter adding in random phase is presented. In particular, the case of two components (which may be the two magneto-ionic components) and scatter is investigated in detail and curves for different amounts of scatter and fixed components are given.

140 pages. \$1.75. MicA54-3010

A STUDY IN THE DESIGN OF MAGNETIC CIRCUITS EMPLOYING SOFT MAGNETIC MATERIALS AND SUPERPOSED A-C AND D-C MAGNETIZATION

(Publication No. 10,033)

John Truman Ludwig, Ph. D.
University of Minnesota, 1954

A method of synthesizing optimum iron-and-air magnetic circuits for inductors with unsymmetrical currents is presented. This synthesis method will provide the physical design when the electrical requirements are given. Methods of analyzing iron core inductors are also presented. These analysis methods provide the electrical parameters when the physical design is given, and they make use of Karapetoff-type air gap lines drawn on the various induction curves to obtain the inductance when either the current or voltage is specified.

The synthesis method is an extension of the work by Legg. The restrictions of small a-c components and d-c resistance as the only size-limiting factor have been removed. The heating of the inductor is considered as a separate size-limiting factor, and the dissipative effects of core losses are included. Methods are included for those specifications for which the optimum design has no air gap and for those specifications having linearity requirements which limit the maximum induction.

100 pages. \$1.25. MicA54-3011

PERIODIC SOLUTIONS IN HIGHER ORDER NONLINEAR SYSTEMS

(Publication No. 9141)

Bernard Silverman, Ph. D.
University of Illinois, 1954

In this thesis the steady-state analysis of a particular network configuration containing two nonlinear elements associated with other linear network elements is presented. This is a special case of a system having at least two degrees of freedom and containing two nonlinear components. The nonlinear elements may be either triode or pentode vacuum tubes or any other nonlinear devices having similar characteristics. The network is considered both as a system driven by sinusoidal generators and as a self-excited oscillator whose output is almost sinusoidal. By restricting the analysis to a range in which there is no flow of grid current in the vacuum tubes, these vacuum tubes (or nonlinear elements) may be treated as two-terminal devices and the steady-state behavior of the system can be determined. The analysis is then applied to a two-stage oscillator, and the results of this analysis are shown to be in good agreement with values measured in the laboratory.

The general method of attack consists of isolating each nonlinear component as a two-terminal network leaving the remainder of the system as two linear four-terminal networks. The characteristic of each nonlinearity is given by expressing its plate current as a function of its control voltage which is the weighted sum of its plate-to-cathode and grid-to-cathode voltages. The circuit equations for the linear networks are written, and the expressions for the nonlinear elements are substituted into these equations which are solved to obtain approximate steady-state values for both plate currents. These, in turn, allow the determination of the steady-state behavior of the entire system.

Next, the driving generators are removed from the network and its steady-state oscillatory behavior is examined. A first order approximation for the amplitude and frequency of the fundamental component and higher harmonics of an almost sinusoidal oscillation is determined. To do this, it is necessary to obtain the approximate periodic solution of a fourth order nonlinear differential equation representing the given multimesh network which contains two nonlinear elements. Further, it is shown that if one of the nonlinearities is removed, the derived results reduce to those previously obtained for similar systems containing one nonlinear device.

This analysis is applied also to a specific example, and in each case the calculated and measured values agree within a few per cent.

To obtain analytical expressions for the control characteristics of the triodes used as nonlinear elements, their static plate characteristics are taken and their control characteristics plotted. These latter characteristics are then approximated by third degree polynomials on a least-squares basis.

95 pages. \$1.19. MicA54-3012

THE RESPONSE OF LINEAR NETWORKS TO A FORCING FUNCTION OF THE FORM $\cos t^2$

(Publication No. 9905)

Walter Jackson Williams, Jr., Ph. D.
Purdue University, 1954

Major Professor: E. M. Sabbagh

The numerical response of a given network to a forcing function of the form $\cos t^2$ can be calculated from the data and formulae given in this thesis. The given network, however, is subject to certain limitations. These limitations are: the network must be finite, linear, passive, bilateral, and lumped-parameter; and the Laplace transform of the impulse response of the network cannot contain poles of higher order than the second. The given network can be a mechanical network as well as an electrical network as long as the above limitations are met.

A forcing function of the form $\cos t^2$ has an instantaneous frequency that varies linearly with time. Such a forcing function is encountered in the acceleration of reciprocating engines, in spectrum analyzers, and in devices which are used to produce the frequency response curve of a network on the screen of a cathode-ray oscilloscope.

The response is presented as the inverse transform of the product of the Laplace transforms of the forcing function and the impulse response of the network. The Laplace transform of the impulse response of the network is expanded in partial fractions. By use of the convolution integral, the response is given for each possible term that might occur in a partial fraction expansion. For a complicated network, the total response is the sum of the various appropriate responses given in this thesis.

The response for each term in the partial fraction expansion is divided into two parts: the transient part and the steady-state part. The terms involved in the response are relatively simple to evaluate numerically with the exception of an integral. This integral is the error integral with complex limits. The magnitude of this integral, as a function of time, contains an oscillation. The integral is divided into two parts: one part is oscillatory; the other part is non-oscillatory. The oscillatory part is a simple function that is easily calculated. The non-oscillatory function is calculated by means of power series expansions. A digital computer was used to obtain data that can be used to evaluate numerically the non-oscillatory component of the integral for any given problem. This data is presented in tabular form.

Three power series expansions that were used to obtain the numerical solution of the integral are given. Two expansions are asymptotic and the third is convergent.

In the numerical evaluation of a mathematical function, such as the above integral, approximations can be used in many cases to shorten the amount of necessary effort to obtain a solution. Various approximations of this nature are discussed in detail.

The numerical responses of two different networks are presented as examples. One network is

an R-L-C series network, and the other is a low-pass filter. Experimental verification is given for the calculated response of the R-L-C series network.

A forcing function of the form $\cos t^2$ is a type of frequency modulation. To illustrate the distortion produced in the instantaneous frequency of the response by a network, the curve of the frequency of the response versus time is given for the example of the R-L-C series network. This example shows that a large amount of distortion could be produced in the output of a frequency modulation system due to networks in the system.

171 pages. \$2.14. MicA54-3013

ENGINEERING, MECHANICAL

GENERALIZED THERMODYNAMIC PROPERTIES OF GASES AT HIGH DENSITIES

(Publication No. 9749)

Benjamin Gebhart, Ph. D.
Cornell University, 1954

As a result of the considerable amount of P-V-T data determined by many investigators for a large number of pure fluids, much is known concerning the behavior of many important substances over a fairly wide density range.

Many attempts have been made to express compactly the behavior, in the gas phase, of at least a group of these substances. Several of the most successful attempts result from the use of a generalizing technique based upon the properties of the substance at the critical point. These techniques are, in form at least, applications of van der Waals law of corresponding states.

Two recent presentations of generalized P-V-T behavior are of particular interest. In Su and Chang presented a generalized form of the Beattie-Bridgeman equation of state, along with values of the five constants, which agreed with the behavior of a large group of substances up to critical density. Nelson and Obert presented a series of compressibility diagrams which covered with acceptable accuracy an even larger group of important gases in an even greater density range. These two presentations are in essential agreement.

The success of these methods of behavior presentation on the basis of generalized properties makes appropriate the extension of the properties covered to others of wide interest such as entropy and enthalpy. Several limited treatments of this kind are to be found in which entropy and enthalpy changes along isothermals are determined.

The present work consists essentially of a tabular and graphical description of the generalized entropy and enthalpy behavior, above a particular datum, of gases whose behavior fits the generalization chosen. The generalized Beattie-Bridgeman equation with the constants derived by Su and Chang was used. The

range covered by the results is from one to ten times the critical temperature and up to critical density.

Expressions for the changes of entropy and of enthalpy at constant temperature and volume were derived. These were then combined to give expressions for changes in entropy and enthalpy from a datum state to any other state in the region of interest.

Both of the resulting expressions can be written in forms with two sets of terms; one set involving reduced temperature and volume and the other set involving reduced temperature and a specific heat at zero pressure. This unavoidable complication necessitates a correction procedure.

The datum chosen was at low density and at critical temperature. A value of the constant volume specific heat was chosen. Correction techniques were developed which permit the use of the chart or tables for gases of different specific heat or of different standard entropy and enthalpy variation with temperature. The behavior chart coordinates were selected as the natural logarithm of reduced temperature and entropy divided by the gas constant. The chart contours are reduced volume, reduced pressure and enthalpy divided by the critical temperature and gas constant.

All results were machine computed to six decimal places and are tabulated to four permitting accurate interpretations of small scale state changes.

The results of this work were checked against several recent determinations of the properties of carbon dioxide and the results were satisfactory.

91 pages. \$1.14. MicA54-3015

THE TIME VARIATION OF THE SPATIAL DISTRIBUTION OF COOL FLAME RADIATION IN AN ENGINE CYLINDER

(Publication No. 9867)

James Edward Getz, Ph. D.
Purdue University, 1954

Major Professor: Dr. John T. Agnew

The objective of this investigation was to determine if cool flames in an engine cylinder originate simultaneously throughout the mixture or if cool flames originate at some location(s) and then propagate throughout the combustion chamber.

The problem was approached by using a modified CFR engine of ell-head design with a fused quartz window (4.65" x 6.59" x 1") for viewing the entire combustion chamber. A 931-A photomultiplier tube was used as the radiation detector. A steel template containing 52 holes served as a grid for viewing small regions of the combustion chamber. The engine operating conditions consisted of:

Speed	900 RPM
Air-fuel ratio	13:1
Spark timing	20° after TDC
Head cooling water	70-85°F

Block cooling 175°F average
water

Mixture temperature variable

Compression ratio 7.0:1

Fuels 30% n-heptane 70% toluene by volume
40% n-hexane 60% toluene by volume
50% n-pentane 50% toluene by volume

The results and conclusion included the following:

(1) The chemical composition of the charge in an engine cylinder at the time of spark discharge is substantially different from the air-fuel mixture supplied to the engine.

(2) At low mixture temperatures the cool flame first appeared in the region of the valves and then propagated across the combustion chamber at an average speed of 75 ft./sec. which required 27 crankshaft degrees. The word propagation is used in the sense that it is a spreading or enlarging of a flame front in space with respect to the material being consumed and that this self-sustained movement is the result of a transfer of thermal energy and chain carriers.

(3) At high mixture temperatures the cool flame first appeared in the region of the valves, propagated a short distance at ca. 75 ft./sec., and then moved across the remaining major portion of the combustion chamber at a speed of ca. 500 ft./sec.

(4) At intermediate mixture temperatures, a behavior intermediate between the above two phenomena resulted.

(5) These investigations indicate that neither the appearance nor the time of peak intensity of cool flame radiation are simultaneous over the entire combustion chamber; therefore, caution should be exercised in correlating radiation traces with other variables such as pressure development.

(6) The large quartz head had a pronounced effect on the temperature of the incoming mixture. As a result, data from a quartz head and a steel head were radically different for the same mixture temperature.

(7) As the mixture strength was enriched, a point was reached where there was an abrupt decrease (almost may be considered a cutoff) in cool flame intensity.

(8) Shutting off the spark resulted in a shift of the peak intensity to later times and a change in intensity. This effect is attributed to a carrying over of certain products in the residual gas.

Such topics as two peaks in the cool flame trace, cool flames and knock, and effect of gaseous additives on the cool flame are treated briefly.

The author cites 86 references and lists 127 additional related references.

177 pages. \$2.21. MicA54-3016

HEAT TRANSFER COEFFICIENTS AND PRESSURE DROP IN THE FLOW OF LIQUID METAL ACROSS A BANK OF TUBES

(Publication No. 9754)

Robert Julius Hoe, Ph. D.
Cornell University, 1954

Studies have been made of the heat transfer of coefficients in the flow of mercury across a bank of tubes. Coefficients were obtained for several representative positions in the lattice or tube bank. Local coefficients have been obtained as a function of angle around the tube, while average coefficients were found by integration of the curves of local coefficient versus angle for various values of the Reynolds Number.

The question of wetting has been investigated and the pressure drop across the lattice measured.

The lattice chosen consisted of seventy 1/2" tubes, seven rows wide and ten rows deep with a staggered equilateral triangular arrangement of 11/16" pitch.

The velocity of the mercury, v , across the tube bank was varied from 0.42 to 2.25 ft/sec. This corresponds to a range of Reynolds numbers (N_{Re}) from about 15,000 to 83,000. The system however was operated at nearly constant temperature so the Prandtl number (N_{Pr}) was not a variable. Chromeplated tubes were used for "non-wetting" data while copper tubes which amalgamated with the mercury were used for the "wetting" runs.

The average heat transfer coefficients (\bar{h}) for the chrome tubes varied from about $\bar{h} = 1700$ at $N_{Re} = 15,000$ to $\bar{h} = 4200$ at $N_{Re} = 80,000$ for the central group of tubes in the lattice. The scatter of data was less than plus or minus 10% except for some unusual points at N_{Re} greater than 70,000. The variation of coefficient with Reynolds number can be expressed for this case by

$$\bar{h} = 11.6 (N_{Re})^{0.52}$$

The tubes around the periphery exhibited coefficients from 10 to 20 per cent lower than the central group.

For the copper tubes the average coefficient for the tube in the exact center of the lattice varied from about $\bar{h} = 2000$ at $N_{Re} = 15,000$ to $\bar{h} = 6000$ at $N_{Re} = 80,000$ while the values for the tube in the front of the lattice were less than 10% below these. The equation representing the data for the central tube is given by the expression,

$$\bar{h} = 3.45 (N_{Re})^{0.66}$$

Some data were obtained which indicated that "wetting" had occurred with the chrome-plated tubes at Reynolds numbers greater than 70,000. Since this appears to be inconsistent with the usual concepts of "wetting" and "non-wetting," it is recommended that the term "thermal contact resistance" be used in describing the conditions at the liquid-solid interface which affect heat transfer. The decrease in thermal contact resistance at the high flow rates is apparently due to the increased impact pressure which results in a better contact between the mercury and tube wall surface and thus increases the rate of electron conduction across the interface.

The distribution of local coefficients, (h) with the angle around the tube is in general quite symmetrical. The maximum coefficient occurs near the front of the tube and drops off smoothly around the sides reaching a minimum of from about 1/3 to 2/3 the maximum at the rear. The differential between front and rear is a minimum for the lowest values of the Reynolds number and increases with N_{Re} until, at the high values, the spread between front and rear is the greatest.

For example, for one tube location the variation of coefficient is from about $h = 1300$ at the rear to $h = 1900$ at the front for $N_{Re} = 20,000$. However at $N_{Re} = 80,000$, $h = 3000$ at the rear and $h = 6000$ at the front.

Since the Prandtl number was not varied it was not considered advisable to express the coefficient in the usual form of

$$N_{Nu} = f (N_{Re}, N_{Pr})$$

Pressure drop data indicates that the liquid metals are not different from conventional fluids in this respect. Using the equation^{1*} for pressure drop, Δp ,

$$\Delta p = \frac{4 f G_{max}^2 N}{2 g_c \rho}$$

the friction factor, "f" can be fairly well represented by the relationship

$$f = 0.173 (N_{Re})^{-0.1}$$

for the present arrangement. "N" is the number of rows of tubes, ρ , the density and g the gravitational constant.

The calculations for the Reynolds number have been based on the outside diameter of the tube; the value of G_{max} is the mass rate of flow at the minimum cross-sectional area; and the fluid properties have been determined at the average film temperatures. All properties of the mercury were obtained from the "Liquid Metals Handbook," second edition.²

259 pages. \$3.24. MicA54-3017

*Superscripts refer to numbers of references.

THE INFRARED DIFFUSE REFLECTANCE CHARACTERISTICS OF VARIOUS SURFACES AND MATERIALS

(Publication No. 9879)

Richmond Beckett McQuistan, Ph. D.
Purdue University, 1954

Major Professor: John T. Agnew

Goniometric measurements have been made to determine the angular distribution of infrared radiation which has been reflected by surfaces of various materials and different roughnesses. The reflecting surfaces were composed of solid materials as well as

packed layers of granules and powders. Quartz and calcium fluoride filters were employed to select the wavelength band which was incident upon the various samples.

Arbitrary factors have been established to facilitate the evaluation of a given surface with regard to its use as a diffuse infrared standard.

These measurements have shown that of all the surfaces examined, a surface of flowers of sulfur was best suited for use as a diffuse infrared reflectance standard.

It has been shown that there is a definite correlation between the infrared reflectivity of an anodized aluminum surface and the thickness of the anodized layer.

Calculations were made to show the value of gonio-metric reflection and emission data with regard to radiative heat transfer.

110 pages. \$1.38. MicA54-3018

THE STIMULATION OF INFRA-RED SENSITIVE PHOSPHORS AS A FUNCTION OF TEMPERATURE AND WAVELENGTH

(Publication No. 9889)

Burton Woodruff Randolph, Ph. D.
Purdue University, 1954

Major Professor: Dr. John T. Agnew

The experimental phases of the thesis problem were essentially two-fold: (a) to determine the variation of stimulation signal-to-noise ratio, R_{S-n} , with time after the end of excitation of L-2150, a powder type sample thought to be ZnS plus possibly introduced impurities (b) to determine the variation of stimulation R_{S-n} with phosphor temperature and stimulating wavelength of the powder sample in (a), of a powdered sample of Standard VII (SrS:Ce:Sm), and of a button of Standard VII.

The time variation of R_{S-n} was observed by dividing the phosphor sample into two areas, one of which received the stimulating infra-red radiation, viewing each area with a 1P21 photomultiplier tube, bucking the outputs of the two tubes against each other via the balanced input feature of the Dumont 304-A oscilloscope, and photographing the first 200 milliseconds of the externally triggered trace.

The temperature and stimulating wavelength variation of R_{S-n} were produced by conductively cooling or heating the sample in an evacuated chamber from -150°F. to $+275^{\circ}\text{F.}$ and periodically irradiating the sample with selected infra-red wavelengths from a Perkin-Elmer monochromator which employed an NaCl prism as the dispersing medium. Photographs of all traces were taken ten seconds after the end of excitation which was accomplished with a mercury vapor arc.

The stimulation R_{S-n} of L-2150 was found to be constant with time from 35 milliseconds to one minute after excitation had ceased; it diminished gradually for times increasingly greater than one minute.

The results of the temperature and wavelength variation of R_{S-n} were as follows: (a) L-2150 exhibited a maximum stimulation sensitivity between 1.28 and 1.32 microns; the temperature for maximum stimulation varied between 45° and 70°F. ; the lower and higher critical temperatures (below and above which stimulation could not be effected) were about -120°F. and $+240^{\circ}\text{F.}$ respectively; R_{S-n} exhibited a maximum as both temperature and stimulating wavelength were increased when the other was held constant (b) the powder form of Standard VII showed a maximum stimulation sensitivity between 1.02 and 1.05 microns; the critical temperatures were -40°F. and $+230^{\circ}\text{F.}$; the temperature for maximum stimulation was about $+125^{\circ}\text{F.}$ (c) the button form of Standard VII (which yielded R_{S-n} values as high as 20) showed a maximum stimulation sensitivity which appeared to increase from 1.01 microns at -71°F. to 1.08 microns at $+244^{\circ}\text{F.}$; short and long cutoff wavelengths remained constant between -30°F. to $+204^{\circ}\text{F.}$; a primary temperature R_{S-n} maximum was found at about 50°F. and a secondary at $+205^{\circ}\text{F.}$, both independent of stimulating wavelength; the lower critical temperature was -120°F. for wavelengths up to 1.2 microns.

82 pages. \$1.03. MicA54-3019

THE EFFECTS OF EDGE THICKNESS AND EDGE SHARPNESS ON SMALL ORIFICES

(Publication No. 9897)

Lawrence William Thrasher, Ph. D.
Purdue University, 1954

Major Professor: Dr. R. C. Binder

The literature on orifice meters was surveyed. Several attempts to find a satisfactory test of edge sharpness were made. A statistical analysis of variance was applied to discharge coefficient data from previous tests to detect the effects of edge sharpness and of the size of orifice meter pressure taps.

It was found that any deviation from a sharp edge caused an increase in the discharge coefficient. Though the best test of edge sharpness at the present seems to be examination of the edge under a microscope, there is a need for a test which will actually measure the sharpness of an orifice edge. The value of the discharge coefficient was effected slightly by the size of the meter pressure taps.

Fifteen orifice plates having various diameter ratios and edge thicknesses were tested in a flow circuit using water. A statistical study of the data improved the analysis of the test results.

When the orifice edge thickness was less than $1/40$ of the pipe diameter, there was no effect of edge thickness on the discharge coefficient. Thicker orifice edges caused an increase in the discharge coefficient. The increase became greater as the diameter ratio and as the Reynold's number decreased.

68 pages. \$1.00. MicA54-3020

THE MECHANICS OF FINE SIEVING

(Publication No. 10,044)

Kenneth Thomas Whitby, Ph. D.
University of Minnesota, 1954

Major Advisor: Newman A. Hall

It has been found that for the non-steady state conditions during test sieving on such a machine as the standard Tyler Rotap, the mechanism of sieving can be divided into two distinctly different regions with a transition region between.

Region 1 exists when there are many particles much less than the mesh opening still on the sieve. During region 1 the cumulative % by weight thru the sieve at any time t is given by the equation

$$\% \text{ Thru} = C_1 \frac{P}{W} N S^3 \left(\frac{S}{k_s \bar{d}_m} \right)^{\frac{1}{\ln \sigma_{gp}}} t^b \quad (1)$$

Where W = the total weight of material on the sieve at $t = 0$

P = the density of the material

S = the mesh opening size

\bar{d}_m = the mass mean particle size of the original material on the sieve

σ_{gp} = the geometric standard deviation of the material initially placed on the sieve determined at the mesh size on the size distribution curve

N = total number of mesh openings in the sieve

k_s = a constant which is usually very nearly equal to 1

C_1 = a constant depending on the material sieved. Range is from about 0.5 for wheat flour up to about 5 for glass beads

t = time of sieving

b = a constant usually slightly less than 1

Equation 1 has been tested on wheat products, crushed quartz, St. Peter Sand, glass beads and other similar materials. Changes in sieve motion etc. change only the value of C_1 .

As the particles much less than the mesh size are removed the mechanism goes thru a transition period and enters region 2. In region 2 all particles much less than the mesh size have been eliminated from the residue and the particles remaining that can pass the sieve are very near mesh size. The cumulative % thru the sieve versus time curve, has been found to follow the log normal law (i.e. plots as a straight line on log probability paper) in region 2. From this fact it has been shown both analytically and experimentally that the rate at which material passes the sieve in region 2 is given by

$$\frac{d C(w)}{dt} = \frac{100 P_2}{\log \sigma_{gp} t} \phi(z) \quad (2)$$

where: $\frac{d C(w)}{dt}$ = the % by weight passing the sieve per unit time

P_2 = a fundamental probability connected with the sieving in region 2. P_2 depends only on the material being sieved, the sieve motion and the type of sieve (i.e. nylon, silk, wire etc.)

N = number of particles that can pass sieve

σ_{gt} = reciprocal of the slope of the straight line on the log-probability plot of the % thru versus time curve at the size of the sieve mesh opening

$\phi(z)$ = the normal probability function

The law represented by equation 2 has been found to apply to any material, sieve motion, and type of sieve that was tested.

Using equations 1 and 2 the effects of sieve load, sieve motion, material, relative humidity, and sieve material were investigated over a limited range. Also equations 1 and 2 were extended analytically to steady state sieving.

It is believed that the laws described by equations 1 and 2 represent the best fit over the broadest range of conditions of any sieving laws that have been proposed to date. 201 pages. \$2.51. MicA54-3021

MELTING OF ICE FROM TRANSMISSION LINES

(Publication No. 9907)

Tang Wu, Ph. D.
Purdue University, 1954

Major Professor: W. L. Sibbitt

An experimental investigation was made of the melting time current relationship of overhead line conductors under different icing conditions. Ice coatings were formed on cables by freezing ordinary tap water in molds. Cables used in this investigation were

A. W. G. No. 2 solid copper wire
A. W. G. No. 1/0 X 7 copper cable
A. W. G. No. 3/0 X 7 copper cable
300 MCM X 19 copper cable

A Summary of Results Follows

1. Ice coating was usually melted through near the ends of the cable, and the middle section was the last to free from the surface.

2. Cable temperature during melting period was practically at a steady temperature slightly above the melting point of ice.

3. Melting tables and graphs were compiled from the test results. The maximum error of the experiment was estimated as 10%.

4. The direct approach in solving melting rate from the partial differential equation of heat conduction in the ice region was not feasible because of the complicated boundary conditions.

5. Energy transfer across the water film between cable and ice surface was analyzed in an analogy to the film-type condensation on long horizontal tubes, but the attempt was not successful. Since the oxidized layer and air bubbles formed on the cable surface caused an additional temperature drop besides the water film.

6. Melting time equation proposed by Clem and Stewart (refs. 5,33) can be used for an approximate calculation, but the results are in general 30 to 50% smaller than the present test results.

7. A plot of power density vs. melting time correlated all the above test cables of the same test condition into one curve within 15% deviation in melting time.

8. For efficient ice melting, current must be applied soon after ice formed while the wind velocity and air temperature condition are favorable. A power density of 0.4 w./in.² will melt 1/2" ice from cable in one hour when there is no wind and air temperature at 25°F. If wind velocity becomes 20 M.P.H. and air temperature is at 10°F then 1.5 w./in.² will be required to melt the same thickness of ice in the same period of time.

9. The minimum melting load and safety melting current were discussed.

10. The data will serve as a time guide for melting practices. 64 pages. \$1.00. MicA54-3014

ENGINEERING, METALLURGY

HYDROGEN OVERVOLTAGE ON TITANIUM

(Publication No. 9197)

Sheng-Tai Shih, Ph. D.
University of Missouri, 1954

The hydrogen overvoltage is defined as the difference in potential between a working cathode (where hydrogen is being developed) and the reversible hydrogen electrode.

The hydrogen overvoltage on titanium electrode was measured in various concentrations of different electrolytes by the direct method, i. e., potential measurements were made during the passage of electric current. Electrolytes used were the inorganic acids, hydrofluoric, hydrochloric, hydrobromic, and sulfuric; the organic acids, acetic and trifluoroacetic; and the bases, sodium and potassium hydroxide. High purity iodide titanium was used for most of the experiments, but less pure Remington Arms titanium was also used in some experiments with hydrofluoric

and sulfuric acid solutions. With pure titanium in hydrofluoric acid, the effect of adding alkali fluorides in various concentrations, as well as of adding some small amounts of organic substances, was also studied. Most of the experiments were carried out in air because it was found by comparing experiments done in hydrogen that the effect of air is to shift only slightly the hydrogen overvoltage in the more positive direction.

The hydrogen overvoltage on titanium does not obey Tafel's law in the case of hydrofluoric acid, but it does in all other electrolytes. In the case of hydrofluoric acid, it was found that the hydrogen overvoltage bears a linear, instead of logarithmic, relationship to the current density.

The addition of alkali fluorides to hydrofluoric acid makes the hydrogen overvoltage more negative. When a sufficient amount of such alkali fluorides is added, the logarithmic or Tafel relationship resumes, and in the meantime the dissolution of titanium is completely suppressed by such an addition. Arabic gum and agar-agar also makes the hydrogen overvoltage more negative, but methyl blue acts in the opposite direction.

Hydrogen ion concentration was proved to be an important influencing factor for the hydrogen overvoltage on titanium. In general, the higher the hydrogen ion concentration, the more positive will be the a and b constants of Tafel's equation. In the case of hydrofluoric acid, for which Tafel's law fails to apply and a straight line relation between overvoltage and current density exists, an increase in hydrogen ion concentration causes the intercept of the lines to become more negative, but the slope tends to become more positive.

Whether the overvoltage versus current density relationship is linear or logarithmic seems to depend upon whether or not the titanium dissolves in the electrolyte concerned. If dissolution of titanium takes place in an electrolyte with the evolution of hydrogen, the relationship is linear. If dissolution is absent or insignificant, then the relationship is logarithmic. 207 pages. \$2.59. MicA54-3022

SOLID STATE DIFFUSION OF SEVERAL ELEMENTS IN NICKEL AT ELEVATED TEMPERATURES

(Publication No. 10,043)

Richard A. Swalin, Ph. D.
University of Minnesota, 1954

Diffusion rates of manganese, aluminum, titanium, and tungsten in nickel have been determined in the temperature range of 1100° C to 1300° C. Diffusion coefficients of manganese in an alloy of nickel, 5% titanium have also been determined.

A diffusion couple method involving a sectioning technique was used. The sections were analyzed for the solute in question by spectrophotometric methods. The concentration gradients of the solutes were kept

low. The diffusion coefficients were found to be independent of concentration in the range of concentration studied for all alloy systems and thus the Grube method was applicable for determining values of the diffusion coefficients.

The usual temperature dependence of the diffusion coefficients was found, namely,

$$D = D_0 \exp \left(-Q/RT \right)$$

Values of the frequency factor, D_0 , and the activation energy (enthalpy), Q , were calculated for each system and are listed below.

Solute	D_0 (cm ² /sec)	Q (kcal/mole)
manganese	7.50	67.1
aluminum	1.87	64.0
titanium	0.86	61.4
tungsten	11.1	76.8

Manganese was found to diffuse at the same rate in the nickel, 5% titanium alloy as in pure nickel.

The values of Q for solute diffusion were found to be within 15% of that for self-diffusion of pure nickel. This observation is in disagreement with the majority of past work done in other face-centered cubic alloy systems in which activation energies for solute diffusion were found to be much less than those for self-diffusion of the pure solvents. According to the vacancy model for diffusion, one would expect that the values of Q for solute diffusion could be close to that for the self-diffusion of the solvent. The failure of the majority of previous diffusion work to show such an agreement had cast some doubt on the vacancy theory whereas the close agreement between the values of Q for solute diffusion and that for self-diffusion of nickel obtained in this investigation lend support to the vacancy model.

Entropies of diffusion were calculated and were found to be positive in disagreement with most past work but in agreement with Zener's theory of vacancy diffusion.

A correlation between D_0 and Q was observed, high values of D_0 being associated with high values of Q . A semi-quantitative interpretation based on Zener's theory of vacancy diffusion is proposed. Order of magnitude calculations show good agreement with experiment results.

The results of this research lend support to the vacancy mechanism model for diffusion of substitutionally dissolved solutes in face-centered cubic systems.

151 pages. \$1.89. MicA54-3023

THE RATE OF DISSOLUTION OF ALUMINUM IN HYDROFLUORIC ACID

(Publication No. 9201)

Yen-Ngen Wang, Ph. D.
University of Missouri, 1954

The dissolution of aluminum in hydrofluoric acid has been studied by measuring the rate of dissolution

in terms of the volume of hydrogen gas liberated and collected, in mm³/cm²min. A series of dissolution experiments on aluminum in acid solution from 0.1 N to 10 N HF has been carried out. The relationship between the rate of dissolution of aluminum and the concentration of the acid is linear as long as the latter is below 6 N; above 6 N HF, the curve turns upwards.

The effect of adding various amounts of ammonium fluoride or ammonium chloride to 1 N HF solution on the rate of dissolution of aluminum has been studied. Passivation of aluminum took place as a result of a protective film formation on the aluminum surface as soon as the concentration of ammonium fluoride exceeded 0.25 M, or that of ammonium chloride exceeded 0.5 M. The effect of the addition of salts of nobler metals to the acid was to increase the rate of dissolution if the particles of the displaced metal adhered to the surface of aluminum and so acted as local cathodes. This was the case when NiCl₂ was introduced as an addition agent.

No apparent differences in the rates of dissolution were observed between the aluminum as received, and the one cut perpendicular to the rolling direction, or parallel to rolling direction and perpendicular to the rolling plane. Other aluminum specimens were annealed in vacuum at 400°C and 575°C. At 575°C specimens were prepared with or without the presence of copper vapor. No significant differences in rates were found between heated specimens and those not heat treated.

The changes in electrode potential with acid concentration showed that the higher the concentration of the acid, the more negative the potential becomes. The current produced by the Al-Pt cell in hydrofluoric acid could be restored by scratching the electrode surface. Polarization affected the current appreciably at lower concentrations of hydrofluoric acid, but was less pronounced at higher concentrations.

When aluminum was made the anode in a series of concentrations of hydrofluoric acid, a positive difference effect was observed. On the other hand, a negative difference effect was shown to exist when hydrochloric acid was used. Based upon the local elements theory and the experimental results, two general equations for the difference effects have been derived. For positive difference effect, the following expression was justified:

$$\Delta = \frac{k_1 Z' k_2 I}{r_2} = KI \dots \dots \dots (1),$$

where Δ is the difference effect in mm³/cm²min.; Z' the number of active local cathodes per cm²; r_2 the average resistance of one local cell; I the current produced by the electrolytic cell, and, k_1 , k_2 , and K are constants. If, Z'' the number of active local cathodes which corresponds to the increasing rate of self-dissolution caused by the flow of current I , becomes greater than Z' , a negative difference effect appeared which could be represented by equation (2) below,

$$\Delta = \frac{k_1}{r_2} (Z' - Z'')(n_1 - E'_1) + Z'' k_2 I \dots \dots (2),$$

In this equation, the two additional factors not in equation (1) are: n_1 the hydrogen overvoltage of the local cathode, and, E_1 the electrode potential in the acid. Equation (2) is responsible for the appearance of both positive and negative difference effects.

The results were also in agreement with the view that the dissolution of aluminum in hydrofluoric acid is mostly electro-chemical in nature, and the phenomena observed in the experiments of this investigation are readily explained by the theory of local elements. 217 pages. \$2.71. MicA54-3024

ENGINEERING, SANITARY AND MUNICIPAL

MICROBIOLOGICAL FERMENTATION OF DAIRY WASTES

(Publication No. 9172)

Adolph Richard Brazis, Ph. D.
University of Missouri, 1954

Lack of economical and efficient methods of treating dairy wastes has resulted in an extensive study of the role of microorganisms in the breakdown of dairy wastes. Industrial wastes of this type pose a serious problem where treatment is necessary. Processes being used at present have proved to be inadequate in regard to cost and degree of efficiency. Microbial assimilation of industrial wastes has been studied to a limited extent by other investigators.

The microorganisms used in this study consisted of ten species of *Pseudomonas* and eight strains of *Bacillus subtilis*. The *Pseudomonas* species used were: *Ps. aeruginosa*, *Ps. cyanogenes*, *Ps. fluorescens*, *Ps. fragi*, *Ps. graveolens*, *Ps. ichthyosmia*, *Ps. mucidolens*, *Ps. putrefaciens*, *Ps. synxantha*, and *Ps. viscosa*.

The wastes used were collected from a sewer ap-purtenance through which waste waters of the University of Missouri Creamery entered. In this study it was necessary to test the competitive action of the organisms added with those organisms already present in the wastes. A laboratory prepared synthetic waste would not have shown this competition to exist. Other variables which are normally present in dairy wastes, such as detergents, disinfectants, and grit, would also demonstrate some measurable effect upon these added organisms.

Continuous trickling filter filtration, based on the fill-and-draw principle, was used in conjunction with the action of microorganisms in the treatment of dairy wastes. The operation of this filter was based on the rate of application of 460 gallons per square foot per day.

Dairy wastes and microorganisms were subjected to the following phases of study: (1) the influence of microorganisms on dairy wastes stored for eight hours; (2) the influence of microorganisms on dairy wastes stored for eight hours and filtered for sixteen hours; (3) the influence of buffered broth on the action of microorganisms in the treatment of dairy wastes; (4) the influence of standardized phosphate buffer on the treatment of dairy wastes; (5) the influence of buffered broth on the treatment of dairy wastes; (6) the influence of continuous pH standardization on the treatment of dairy wastes; and (7) the dairy waste problem in Missouri.

The results of this study were as follows: (1) Dairy wastes can be economically treated with good results by means of continuous pH standardization; (2) Microorganisms can be used to effectively treat dairy wastes, provided alkalinity is maintained and aerobic conditions for fermentations are provided; (3) Buffered nutrient broths can be added to dairy wastes to cause desirable fermentations by the predominating organisms present in the waste, thus resulting in a stable effluent; and (4) The dairy waste treatment facilities in the State of Missouri are in need of a great deal of improvement.

115 pages. \$1.44. MicA54-3025

FOOD TECHNOLOGY

EFFECT OF WEIGHT GAIN AND WEIGHT LOSS ON CERTAIN BODY AND BLOOD CONSTITUENTS OF RATS

(Publication No. 9950)

Salah-Eldin Mahmoud Loutfi, Ph. D.
Michigan State College, 1953

The influence of diets of different composition on certain body and blood constituents and on the rate of weight gain and weight loss of rats was studied.

During the gaining period two diets were fed ad

libitum to two groups of rats. One diet, containing corn as the main ingredient, was used in an attempt to produce obesity; the other diet, containing wheat and milk solids as the main ingredients, was used as the control diet.

The corn diet used failed to produce obesity in rats, if obesity is interpreted as excess body weight, but the rats on the corn diet had a significantly higher fat content than those on the control wheat diet. The protein, moisture, and ash content of mature rat carcasses were similar for animals on both diets.

The composition of the diet and age were found to

affect the blood cholesterol values. Cholesterol concentration in the blood serum increased with the age of the rats. Blood potassium values were affected by the type of diet, while blood pyruvic acid concentrations were independent of age and diet. A relationship was found between body fat content and the values for blood cholesterol, blood pyruvic acid, and blood potassium.

At the end of the gain-in-weight period the corn-fed rats were paired according to weight, and divided into two groups. One group was fed a diet which was high in carbohydrate, and the other group was fed a

diet which was low in carbohydrate; the rats on both diets were restricted to 12 calories per day. No difference was observed between the effects of the high-carbohydrate and the low-carbohydrate restricted diets on the rate of weight loss of rats or on the body and blood constituents that were studied.

The blood cholesterol content of the rats on the restricted diets was lower and the blood potassium content higher than that obtained for the rats on a control wheat diet. The blood pyruvic acid values were similar for all diets.

137 pages. \$1.71. MicA54-3026

GEOGRAPHY

A LAND USE STUDY IN THE UGANDA PROTECTORATE

(Publication No. 9008)

John Henry Dean, Ph. D.
Clark University, 1954

The planners of development and welfare schemes for the Uganda Protectorate must have specific information about conditions in the country. This study is a geographic analysis of land use in an area of 5,500 acres in the northern part of the Elephant Grass Region of Uganda. The purpose of the study is to increase knowledge about land use conditions in the Protectorate.

Land use in the survey area is a highly complex effect of many physical and cultural conditions. Climate is such that agriculture can be carried on for 12 months of the year. The topography, that of narrow, flat-topped hills separated by wide, shallow valleys, affects the arrangement of soils and vegetation, and the pattern of occupancy. The soils are among the most productive in the Protectorate.

Cultural conditions, such as the density and composition of population, land tenure, and agricultural practices, influence the land use. The population density is about 350 persons per square mile. Baganda, the indigenous people, form approximately 80 per cent of the population. Baganda society consists of large landowners, small landowners, and the landless. Most of the landless occupy tenant farms averaging about six acres. Rents are regulated by native law. Money-making opportunities attract large numbers of outlanders to the area. These Africans find employment as laborers and many lease land on which to grow cotton, giving the landowner a share of their crop as rent. Most of the Africans are peasant cultivators who practice a hoe-type of agriculture. The permanently settled population customarily practices multiple-cropping, inter-planting, and garden agriculture.

Eighty-three per cent of the land of the survey area was found to be arable. About three-fourths of

the arable land was under cultivation. The interest of the Africans in commercial agriculture is indicated by the fact that 61 per cent of the cultivated acreage was planted in cotton and coffee. Thirty-six per cent of the cultivated land was in food crops, chiefly plantains. However, substantial amounts of food crops were cultivated between rows of cotton. Non-agricultural land made up 17 per cent of the total area. The greater part consisted of swamps, swamp forest, and rough grazing land.

Herds of cattle, owned chiefly by the landed class, and sheep and goats were grazed on fallow land, on rough grazing land, and in the drier portions of the swamps. Only one African had improved pasture.

Wobulenzi Town and Kikoma Ginnery occupied .4 of 1 per cent of the area. Containing wholesale buying centers and retailing stores, this business complex is the primary source from which money flows into the area and the chief exits through which money ebbs. Prohibited from engaging in agriculture, the Asians of the area devote full time to their town businesses. Wholesale produce buying centers, Kikoma Ginnery, and most of the profitable businesses in Wobulenzi are controlled by Asians. African shops, most of which are owned by Baganda, have little capital invested.

The greatest problem of the survey area is overcrowding. An increasing population and an economy in which commercial agriculture is expanding indicate that this condition will become more serious.

Concentration of land in the hands of a few Africans will change. The number of small landowners will increase as large estates fractionate through sale and inheritance.

Economic and political nationalism is on the rise among the Baganda. They are agitating for more African control of commerce and complete self-determination. The Protectorate Government is endeavoring to bring about these changes gradually.

Land use conditions of the survey area are typical of the Elephant Grass Region of Uganda. Salient characteristics are also typical of small areas in other parts of British East Africa.

310 pages. \$3.88. MicA54-3027

LAND USE IN SOUTHERN MIDDLE CHILE

(Publication No. 9545)

Roger Edward Ervin, Ph. D.
University of Florida, 1954

Southern Middle Chile, Valdivia, Osorno, and Llanquihue Provinces, is the southern portion of the populated middle one-third of Chile. It is sometimes known as the South. A low Coast Range is on the west, the high Andes are on the east, and the broad Central Valley is between the two ranges. Vulcanism and glacial processes have been dominant in the formation of the physical landscape. Climate is West Coast Marine. Vegetation is dense. Soils owe their origin to volcanic, glacial and fluvio-glacial processes.

The land was originally settled by a few thousand German immigrants who entered Chile between 1846 and 1870. Their influence on the economy of the region is striking. Rural inhabitants consist of the farm owners and the semi-servile *inquilinos*. In contrast to other parts of Middle Chile, the average farm is smaller and the farms are owner-operated.

Agriculture is the dominant form of land use and most of the inhabitants are dependent on agriculture either directly or indirectly. Milk plants, shoe factories, flour mills, fiber mills, and breweries are dependent upon agricultural products. Farming is confined principally to the Central Valley. Methods tend to be more advanced than in other parts of Chile which is shown by higher yields. Wheat, potatoes, and livestock for dairy products, hides, and meat, are the main agricultural products. Fiber crops, flax and phormium, are distinctive to the South. Many agencies of the government have functions pertaining to agriculture which frequently overlap and conflict in their operations. Other problems confronting agriculture are inflation, a shortage of long term credit, and plant and animal diseases and pests.

Forestry ranks second as a form of land use. Valdivia is the center of the nation's forest industry. Evergreen hardwoods predominate among the commercial species. Methods of exploitation are crude and wasteful. Finishing mills, two plywood mills, a veneer plant, paper mill, and wood impregnating plant are industries based on timber resources. Lumber products are the principal export of the region.

The lakes, rivers, mountains, and green landscape make the South an excellent spot for recreation but development of a tourist industry is retarded by distance from populated centers of Chile and other parts of the world.

Transportation is good when compared to other countries in Latin America. Despite this favorable comparison, the development of the region is retarded by long distances to market, poor farm to market roads, and a railroad system which needs modernizing.

There are many excellent hydro-electric power sites. The first generating plant was constructed and opened in 1943. The effects of cheap power are now readily evident.

Mining and fishing are unimportant and undeveloped. Industries based on other than local products

are few in number, a charcoal blast furnace being the most important.

All cities are local farm-market centers. In addition, Valdivia, Osorno and Puerto Montt are governmental, industrial, wholesale, and retail centers. Puerto Varas has tourist functions. La Union is important industrially. Puerto Montt and Corral are port cities.

Trends in land use are toward more modern, diversified farming with emphasis on dairying. The forest industry is slowly progressing and central mills with modern equipment are gradually replacing many of the small, inefficient mills. As transportation improves, the tourist industry will grow and in time the South may become one of the major tourist centers of Latin America. The benefits of hydro-electric power are only beginning to be felt and in the distant future, this resource possibly may attract new industries. Progress in the past is commendable. Initiative and ability are there and with the proper local and national leadership, development of Southern Middle Chile should continue.

345 pages. \$4.31. MicA54-3028

SOME ASPECTS OF THE GEOGRAPHY OF THE YAZOO BASIN, MISSISSIPPI

(Publication No. 9693)

Arthell Kelley, Ph. D.
University of Nebraska, 1954

Advisor: Leslie Hewes

The Yazoo Basin is a distinctive region. Physically, the Basin is a discrete part of the alluvial lowland of the Mississippi. It is characterized by the plantation system of agriculture, by unusual emphasis on cotton, by a high proportion of tenancy, and by a predominantly Negro population. Its development in unusual degree has been based upon protection from floods and upon artificial drainage.

The Yazoo Basin is the super-plantation area of the country. Multiple-unit operations account for over 50 per cent of the farms and 75 per cent of the farmland. Approximately 53 per cent of the farmland is in holdings of 500 acres and over. The area developed as a plantation region because of its superior soils, its level surface, and the difficult task facing small land holders in combating the problems created by floods, inadequate drainage, land clearing, and malaria. In the early development of the Basin, levee building and land clearing fell to the Negro slave. After the Civil War and the development of the plantation land tenure system, land clearing fell to the Negro sharecropper, who often received several years free rent for his labor of clearing the land.

Because of the problems of floods, drainage, and land clearing, coupled with the fear of malaria, the Basin developed much later than the remainder of the state. Northern Mississippi was opened to settlement in 1832, but the Basin received its greatest influx of population between 1900 and 1930, after the completion

of a continuous levee system, made possible by the Federal government. Drainage reclamation began on a large scale about 1910, but reclamation has been greatly handicapped by the localization of effort.

The plantation remains dominant in the Yazoo Basin at present. The plantation because of its size and earnings can take better advantage of mechanical equipment, soil specialists, plant breeders, and agricultural engineers. The plantation owner, with his access to capital, is able to drain, improve, and bring into production land that would otherwise remain marginal or unproductive.

The soil, climate, and topography make possible the production of a superior grade of cotton and high yields. Before the advent of the boll weevil and crop control, cotton occupied 78 per cent of the cropland. Cotton now occupies 57 per cent of the cropland. Although acreage in cotton has dropped, production has not. Through more scientific farming, yields have risen from an average of 208 pounds of lint per acre

in 1932 to 450 pounds in 1953. Cotton accounts for approximately 90 per cent of the farm income.

The chief generalizations relative to racial composition and places of residence of population in the Yazoo Basin are: one, the high percentage of Negroes in the population; two, the high percentage of the population that is rural; and three, the sparse population in the southern end of the Basin, an area that is subject to backwater flooding.

Mechanization, especially the mechanical picker, and acreage allotments have caused some changes in the organization of plantations. Before the use of mechanical equipment, 60 per cent of the labor required to produce cotton was in the chopping and picking; with increased mechanization, 80 per cent of the labor requirement is in chopping and picking. Tenancy is on the decrease and more wage labor is being used. Plantations are increasing in size. Cash crops other than cotton, such as soybeans, rice, and small grains, are gaining in importance.

273 pages. \$3.41. MicA54-3029

GEOLOGY

THE GEOCHEMISTRY OF THE GROUND WATERS OF NORTHEASTERN FLORIDA AND SOUTHEASTERN GEORGIA

(Publication No. 9566)

Eugene Brown, Ph. D.
University of Florida, 1952

A study has been made of the geochemistry of the ground waters of Northeastern Florida and Southeastern Georgia in which the basic topographic, geologic, and hydrologic data are presented. Following a brief review of the history and development of geochemistry there is presented a discussion of the basic principles involved in the migration of the elements in the hydrosphere. Each element commonly occurring in natural waters is considered in regard to its abundance and geochemistry, its minerals, and its cycle in the hydrosphere. This discussion forms the theoretical basis for the evaluation of analytical data gathered during the study. The various topographic areas of the Atlantic and Gulf Coastal Plain lying within the area studied are outlined and described with respect to the influence of geology upon topographic features. The geology and hydrology of the Area is presented in some detail with a discussion of formations ranging in age from the Tuscaloosa formation of the Gulf Series (Upper Cretaceous System) to the Hawthorn formation of the Miocene Series. On the basis of analyses of water from representative wells penetrating the various geologic horizons, the waters from these horizons are classified and an attempt made to correlate them with geologic sections. The direction of flow of underground water as deduced from chemical considerations was found to agree well with that based upon physical data. The geologic formations

underlying the area are shown by cross-sectional maps drawn in both North-South and East-West directions. Maps are presented illustrating the total hardness, sulfate concentration, and general chemical quality of water throughout the area studied.

151 pages. \$1.89. MicA54-3030

THE PETROLOGY OF UNDERCLAYS

(Publication No. 9136)

Leonard Gene Schultz, Ph. D.
University of Illinois, 1954

Four hundred samples of underclays and associated rocks collected from the Appalachian, Illinois, and Mid-Continent basins were analyzed for the purpose of determining their regional, stratigraphic, and profile variations in clay mineral composition. Underclays are composed principally of kaolinite, illite, a mixed-layered illite-montmorillonite-chlorite material, quartz, and often a 14A⁰ component ranging from vermiculite to fairly well crystallized chlorite; the mineralogy of associated shales, sandstones, and slates closely parallels that of nearby underclays, but they usually contain slightly less kaolinite and mixed-layer material and more crystalline chlorite. A method was developed for quantitative evaluation of the clay minerals so that the mineralogy of all samples could be readily compared.

Regionally, underclays are usually less kaolinitic in the geosynclinal parts of sedimentary basins than in the shelf areas. Stratigraphically, lower Pennsylvanian underclays are more kaolinitic than those from the upper Pennsylvanian; the change is first

noted in the Mid-Continent Basin and occurs at higher and higher horizons toward the east where the decrease is less marked. The underclays in parts of the column with abundant marine beds tend to contain little kaolinite and abundant mixed-layered material.

Field observations together with the lack of mineralogical variations within underclays paralleling those of modern soils indicate that they are not the residual soils on which the coal forming flora grew. Yet, the mineralogy of underclays is in many ways similar to that of modern soils. They are thought to be reworked soils which were formed during a period of relatively slow erosion and deposition. The excess kaolinite and mixed-layer material are thought to be the result of leaching in the source area or at intermediate sites of temporary deposition between the source and the final place of deposition. One such intermediate site was probably a redbed environment. Redbeds commonly occur at coal horizons where the coal is absent; they have the same mineralogical features as underclays; the well drained, oxidizing environment which their red color implies would be a favorable one for the development of the excess kaolinite characteristic of both themselves and underclays. Slicken-siding and the lack of bedding in underclays is attributed to flocculation of the clay combined with slipping when the hydrous mass was compacted. 126 pages. \$1.58. MicA54-3031

THE SURFACE GEOLOGY AND PLEISTOCENE HISTORY OF THE WATERTOWN AND SACKETS HARBOR QUADRANGLES, NEW YORK

(Publication No. 10,094)

David Perry Stewart, Ph. D.
Syracuse University, 1954

Adviser: Earl T. Apfel

The purpose of this investigation was to map and describe the details of the surface geology of the Watertown and Sackets Harbor quadrangles and to relate the topography to the glacial processes that formed them. The problem, therefore, was to map the surface forms in detail and to interpret the resulting map and information accumulated during the survey.

During the Pleistocene Epoch, northwestern New York was repeatedly covered by the Laurentide Ice Sheets. In the Watertown and Sackets Harbor quadrangles, however, the manifestations of earlier stages were destroyed by subsequent glaciation, and, therefore, all of the existing surface materials were deposited by the Cary and Mankato substages of the Wisconsin ice episode.

At the beginning of the Mankato, and no doubt during earlier advances of the Wisconsin glacier, a segment of the expanding Ontario Ice Lobe in the St. Lawrence Valley invaded the area from the north-

northeast. Upon encountering the northern promontory of the Tug Hill Escarpment, the ice was divided into two lobes which moved down either side of this plateau. Later, the advancing ice thickened sufficiently to move over the summit of Tug Hill.

On Tug Hill, the drift is quite thin, and the bedrock is everywhere apparent near the surface. The Tug Hill drifts north of Sandy Creek are of Mankato Age. They overlie limestones, and the drainage still has an angular pattern due to its recent origin. South of Sandy Creek, the drift is older (Cary), is composed chiefly of shales and sandstones, and the drainage has had sufficient time to develop a dendritic pattern.

The Black River Valley section of the Ontario Lake Plains is relatively flat because the Trenton beds were planed from over the more resistant Black River Group. South of the Black River Valley, however, the lake plain has an irregular surface expression caused by bedrock escarpments resulting from the differential effects of ice erosion on the variable Trenton beds. Since the Trenton limestones are interbedded with shale, glacial erosion was chiefly a matter of planation along layers weakened by shale partings. The results were the carving of steep-sided, step-like terraces, isolated bedrock remnants, and deep channels paralleling the ice direction.

Lake Iroquois expanded over the Ontario Basin as the Mankato ice receded. Shore phenomena of this episode are found along the slopes of the Tug Hill Escarpment between the Black River and the southern boundary of the area mapped. The highest lake level is marked by a band of washed off till, consisting of a concentration of residual boulders following the removal of finer sediments by wave action. This high shore now has an elevation of 700 feet at Allendale, rising gently to an elevation of 745 feet east of Watertown. Between Watertown and Adams Center, a gradual lowering of the highest lake level is recorded by beach gravel and ridges. A stable shore, marked by washed off till, ninety feet below the high water mark, is believed to represent the Lake Frontenac shore.

Between Adams Center and the southern boundary of the area mapped, the high shore is not well marked. Here, a large offshore bar was built by wave action. The bar is best developed between Adams Center and Adams, its position being over a mile west of the highest lake shore.

The lake plain section of the Watertown and Sackets Harbor quadrangles has been severely eroded by wave action in many localities. Large areas of bedrock are now exposed, but erratic boulders on the surface attest to the fact that relatively thick accumulations of till once covered them.

Shore features of the fresh water Gilbert Gulf episode in the Ontario Basin are best developed in the extreme southwestern part of the Sackets Harbor Quadrangle. Here, the Gulf shore now follows closely the three hundred foot contour. Although evidences in the northern part of the quadrangle are not conclusive, it is believed that the shore line is nowhere over one hundred feet above the present level of Lake Ontario. 156 pages. \$1.95. MicA54-3032

HEALTH SCIENCES

HEALTH SCIENCES, GENERAL

THE RELATIONSHIP BETWEEN CERTAIN PHYSIOLOGICAL VARIABLES AND THE ELECTROKYMOGRAPHIC RECORDING OF VENTRICULAR ACTION

(Publication No. 10,045)

Joseph Jorgens, Ph. D.
University of Minnesota, 1954

The purpose of this project was to explore the relationship between the changing ventricular absorption mass (ventricular action) and cardiac output. To do this, a new type of logarithmic electrokymograph was built and tested for its frequency response, fidelity, reproducibility, and inherent characteristics. It was applied in the course of this study to over 500 subjects.

This electrokymograph was designed so that the height of the recorded curve could be quantitated to compare curves from different subjects. This curve is a record of the changing mass absorption of the heart during the cardiac cycle as detected by a photomultiplier tube electrokymographic head. It was established that the height of the curve approaches linearity with mass absorption over the range studied.

The height of the curve from a subject divided by the height of a curve of a reference absorption mass is the ventricular deflection ratio. Since this is a new measurement of the average ventricular action over a 15.4 square centimeter area, it was related to twelve physiological variables, two of these were statistically significantly related - lean body mass and vital capacity.

Through a new technique the mass absorption of the heart is measured giving an index of heart thickness and of heart size. Since the value of this index was unknown, it was related to twelve physiological variables. Of these three were found to be significantly related - weight, surface area and lean-body mass.

The electrokymographic index of stroke volume (product of heart thickness and ventricular deflection ratio) was related statistically to fifteen physiological variables. Of these four were found to be significantly related - lean-body mass, surface area, weight and vital capacity. The index of stroke volume increased significantly when subjects were retested after exercise and after eating.

The product of the index of stroke volume and pulse rate constitutes the electrokymographic index of cardiac output. In a thirty subject group the electrokymographic index of cardiac output was statistically significantly related both to oxygen consumption per minute and to a reference cardiac output (acetylene method).

The electrokymographic index can be used to record the amount of ventricular action in a given subject under physiological testing or clinical situations. This index is most reliable when applied to group trends. Patients with hyperthyroidism and cirrhosis were found to have a significantly higher electrokymographic index mean than the normal standard. In patients with recent myocardial infarction the mean of the index was found to be in the lower range of normal. Electrocardiographic tracings illustrating valvular and pericardial lesions, are included in this thesis.

253 pages. \$3.16. MicA54-3033

HEALTH SCIENCES, DENTISTRY

LACTIC ACID FORMATION IN LACTOBACILLI EXPOSED TO FLUORIDIZED ENAMEL

(Publication No. 9610)

Jack D. Zwemer, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1954

The inhibition of acid production in oral microorganisms exposed to fluoridized enamel was investigated *in vivo* as a possible factor in the control of dental caries.

The intact upper central incisors of 14 young adult males were isolated and cleaned according to clinical procedures. An aqueous, unbuffered solution of sodium fluoride (4% w/v) was applied to the labial surface of one incisor in each subject for 20 minutes. Saline was applied to the contralateral tooth as a control. Microvolumes of a 25% washed cell suspension of *Lactobacillus casei* #4646 in a 0.2 M acetate buffer (pH 4.5) were confined to each of the teeth at an interval as long as seven days after treatment. Measurements were then made of lactic acid in each suspension after a 30 minute incubation on the enamel.

A 56% inhibition of lactic acid formation was demonstrated in suspensions confined to the fluoridized teeth immediately after treatment. The inhibition, however, diminished to 14% in a 24 hour exposure to saliva and completely disappeared within seven days.

It may be concluded that the clinical efficacy of topical fluorides in reducing the incidence of dental caries is probably not associated with an inhibition of glycolytic enzyme activity.

53 pages. \$1.00. MicA54-3034

HEALTH SCIENCES, NURSING

**CRUCIAL REQUIREMENTS IN NURSING
FOR THE SCIENCES OF ANATOMY
AND PHYSIOLOGY**

(Publication No. 10,056)

Wilhelmine L. Haley, Ed. D.
Wayne University, 1954

This study was conducted at the Wayne University College of Nursing, Detroit, Michigan, by a science instructor in the Biology Department of the Wayne University College of Liberal Arts.

The objectives of the study were to determine the crucial requirements in professional nursing for the sciences of human anatomy and physiology, based upon the findings of the study. The course investigated is prerequisite to professional courses for students enrolled in the basic program leading to the Baccalaureate Degree in Nursing.

The study was based upon the assumption that the content for the course in anatomy and physiology was not effectively meeting the needs of nursing.

Methodology used for the purposes of the study was an adaptation of the critical incidents technique, designed and developed by Dr. John C. Flanagan. The critical incidents technique determines the crucial requirements of an activity, in terms of individuals' successful or unsuccessful performance while engaged in an activity. Qualified observers write brief descriptions of the performance. Identical or closely related incidents are reduced to suitable categories in a system of classification, and tabulated numerically. Depending upon the frequency of occurrence, the categories are an indication of the essential requirements of the activity studied.

Critical incidents in this study were defined as students' familiarity or unfamiliarity with the principles of anatomy and physiology. In applying these principles to the clinical situation, successful or unsuccessful performance indicated the crucial requirements in nursing for these sciences, and whether present content of the course in anatomy and physiology was suitable or unsuitable for the purposes of nursing.

The clinical areas studied were nursing arts, medical and surgical, pediatric and obstetric nursing.

Incidents were reported by six clinical instructors, one group of students in each area, and the science instructor from the four clinical areas, and were derived from observations of:

Classroom performance - Incidents based upon class discussion related to nursing theory and the application of the principles of anatomy and physiology.

Nursing care performance - Incidents based upon the application of the principles of anatomy and physiology to practice involved in patient care.

Case conference performance - Incidents based upon student presentation and discussion of specific cases, applying the principles of anatomy and physiology to the condition and treatment of patients.

The science instructors' observations were limited to the classroom and to case conferences.

Students participated voluntarily and their reports were unsigned.

Forms were developed for the recording of incidents.

Findings of the study were analyzed as follows:

1. Total incidents reported 878
 - Clinical instructors 359
 - Students 292
 - Science instructor 227
2. Incidents showing adequate preparation . . 127
 - Incidents showing inadequate preparation . 751
3. Incidents related to each system of the human body were reduced to sixty-eight categories:
 - Categories showing adequate preparation 18
 - Categories showing inadequate preparation 50
4. Categories showing inadequate preparation are analyzed as follows:
 - Content requiring greater emphasis . . . 33
 - New content 17
 - Content related to physiology 31
 - Content related to anatomy 19

5. There was no evidence to support the contention that some content of the present course could be eliminated, nor deemphasized.

Major conclusions based upon the findings were:

1. The critical incidents technique was effectively adapted for the purposes of the study.
2. The present course outline may be used as a basis for revising the course in anatomy and physiology.
3. Content requiring greater emphasis was identified. Examples are: chemical mediation of nerve impulses, specific function of the autonomic nervous system and the metabolism of proteins, carbohydrates and fats.
4. New teaching methods must be devised in order to provide greater emphasis to certain items of content.
5. New content to be included in the revised outline was determined. Examples are: chemical nature of hormones, cutaneous reflexes and sedimentation rate of blood.
6. The amount of time allowed for the course should be extended.

A detailed, revised outline of course content for anatomy and physiology for students of nursing is included in the dissertation.

185 pages. \$2.31. MicA54-3035

HEALTH SCIENCES, PATHOLOGY

PATHOLOGY OF *ASCARIS LUMBRICOIDES*
AND *TRICHINELLA SPIRALIS*
INFECTION IN CATTLE

(Publication No. 9918)

Peter Carleton Kennedy, Ph. D.
Cornell University, 1954

Two pathological entities of cattle were studied and reproduction of these diseases was attempted by means of experimental infection with *Ascaris lumbricoides* and *Trichinella spiralis*.

The first disease was characterized by the formation of eosinophilic granulomas in the liver and lungs. The similarity of this condition to a group of diseases of man and experimental animals, which are caused by the migrations of ascarid larvae was pointed out.

The ability of the larvae of *Ascaris lumbricoides* from the pig to migrate in cattle, and the role of these larval migrations in the pathogenesis of focal hepatitis and pneumonia was examined experimentally.

The initial migration of *A. lumbricoides* larvae in calves caused no disturbance of temperature or total or differential leukocyte counts referable to the infection. The lesions produced by single inoculations were minimal and consisted of multiple microscopic foci of necrosis in the liver and petechial hemorrhage in the lung.

Calves exposed to repeated larval migrations developed elevated temperatures, mild respiratory signs, and in one case eosinophilia. The lesions in this group consisted of grossly apparent focal infiltrations of eosinophils in the liver and lungs.

It was not possible to demonstrate a state of sensitization in calves which received serum from a calf that had been repeatedly exposed to ascarid migrations.

Adult cattle inoculated with infective eggs developed an eosinophilia. Repeated migrations of the parasites in these animals produced severe lesions, typical of the lesions seen in the naturally occurring cases. Ascarid larvae were recovered from the lungs of experimental calves and from the lungs of one field case.

The second disease studied was eosinophilic myositis. The histological features of five cases of naturally occurring eosinophilic myositis were described, and the literature on this disease reviewed.

In an attempt to reproduce this disease, three animals, two yearling bulls and one calf were experimentally infected with *T. spiralis*. The course of the disease was followed by hematological examinations, a series of muscle biopsies, and necropsy. An eosinophilic myositis was produced in all three animals, and larval encystment in two. The diffuse muscle involvement seen grossly in the natural disease was not reproduced; even in the severely affected muscles the lesions, though multiple and green, were discrete. The presence of acute changes in muscles showing all stages of eosinophilic myositis including granuloma formation and cicatrization was a consistent feature of the natural disease, and contrasted

with the experimentally produced myositis in which new foci of inflammation did not develop after about the 30th day post infection.

The number of animals employed in these experiments was too small to provide definitive evidence on the various phases of experimental trichinosis in cattle. However, on the basis of histological evidence, the invasion of the muscles by the trichina larvae ceased at about the 25th day after inoculation in each of the three animals. From this it might be presumed that the intestinal phase of bovine trichinosis lasts for approximately 20 to 25 days, a presumption which is supported by the isolation of larvae from the blood of a calf 24 days after inoculation but not subsequently.

Little information was obtained on the fate of the muscle trichinae. It was observed that when a larvae succeeded in becoming encysted in the muscle the reaction subsided, and the impression was gained that, once encysted, the larvae were capable of persisting for a considerable time. The infectivity of the encysted larvae was not examined after the 42nd day after infection, but the larvae were shown to be infective for rats at this time.

103 pages. \$1.29. MicA54-3036

HEALTH SCIENCES, PHARMACY

A STABILITY AND SOLUBILITY STUDY OF
RIBOFLAVIN AND SOME DERIVATIVES

(Publication No. 9547)

Joel John Hertz, Ph. D.
University of Florida, 1954

Numerous methods have been suggested for preparing solutions containing a relatively high concentration of riboflavin. Most of these suggested methods do not show any increase in stability greater than that of the pure vitamin in solution. In this investigation more soluble derivatives were prepared and these were evaluated as to stability and solubility.

The levulinic acid, pyruvic acid and citraconic anhydride derivatives were synthesized. For stability evaluation, solutions of these derivatives were placed in flint and amber bottles and stored in sunlight, diffused light and darkness. Solutions of riboflavin, Flavaxin Soluble and riboflavin-5'-phosphate sodium were also evaluated for stability in the same manner.

Amber bottles were much better than flint for maintaining the vitamin potency of solutions of riboflavin or any of its derivatives. Complete darkness caused only a negligible destruction of the vitamin with all types of solutions. A rapid deterioration occurred with all solutions placed in direct sunlight irrespective of the type of container used.

Riboflavin and its derivatives were more stable at lower pH values. By replacing part of the aqueous phase with glycerin or propylene glycol, the stability

of solutions of the derivatives prepared in this investigation and that of riboflavin-5'-phosphate sodium were more stable than solutions with distilled water. The use of some sun screening agents, especially a saturated aqueous solution of ethyl aminobenzoate, delayed destruction of the vitamin.

Solubility studies with riboflavin and some of its derivatives showed that riboflavin-5'-phosphate sodium had the highest solubility in water. The pyruvic acid, levulinic acid and citraconic anhydride derivatives showed a higher solubility in water than riboflavin. Flavaxin Soluble was slowly soluble in water and higher concentrations were possible at elevated temperatures.

The phenomenon of fluorescence is inherent to riboflavin solutions and, accordingly, additional investigations should be made with the hope of finding a suitable solvent and/or stabilizing agent which would increase the stability of solutions to light.

156 pages. \$1.95. MicA54-3037

EVALUATION OF COLLYRIA BY THE RABBIT EYE METHOD

(Publication No. 9554)

James Robert McCowan, Ph. D.
University of Florida, 1954

The purpose of the investigation was to study the effect of zinc sulfate collyria on the normal and irritated rabbit eye with emphasis on the use of various stabilizing agents, such as aminoacetic acid, potassium sodium tartrate and sodium citrate.

Isotonic collyria were found to be significantly less irritating to the rabbit eye than hypotonic collyria. Buffered collyria stabilized at a pH near that of tear fluids and containing low concentrations of zinc sulfate were slightly more irritating than the isotonic, nonstabilized collyria with lower pH values. Buffered, stabilized collyria containing higher concentrations of zinc sulfate in some instances were found to be less irritating than the unstabilized counterparts but still produced sufficient irritation to justify restriction and discrimination in the use of these stabilized collyria in the eye.

Therapeutic comparisons and determinations of astringency of the various zinc sulfate collyria were made by instilling the collyria into the rabbit eye previously irritated by mustard oil or by exposure to a mercury vapor lamp. Strong evidence of vasoconstriction, astringency or other significant beneficial effects on the irritated eye was not produced by any of the zinc sulfate collyria tested. Several of the collyria increased the severity of inflammation in the irritated eye.

99 pages. \$1.24. MicA54-3038

THE EFFECT OF VARIOUS SUBSTANCES ON THE ANTIBACTERIAL ACTIVITY OF BACITRACIN IN OINTMENTS

(Publication No. 9558)

James McElwee Plaxco, Jr., Ph.D.
University of Florida, 1954

The effect of various substances on the antibacterial activity of bacitracin in ointments was determined by using the agar-plate method and the extraction procedure for the determination of bacitracin potency in ointments as promulgated by the Federal Food and Drug Administration.

Bacitracin was found to be relatively stable up to six months in the presence of Jelene, white petrolatum, liquid petrolatum, white wax, dried wool fat, cetyl alcohol, ascorbyl palmitate, hydroquinone, calamine, zinc oxide, ethyl aminobenzoate, and an ointment base composed essentially of diesters of polyethylene glycol 400.

The following substances slowly destroyed the activity of bacitracin in ointments: stearyl alcohol, cholesterol, Span 20, Span 65, Tween 61, Tween 80, Aerosol OT, sodium lauryl sulfate, hydrophilic petrolatum, two ointment bases composed essentially of Carbowax compounds, and one emulsion type ointment base.

The following substances destroyed the activity of bacitracin in ointments: water, propylene oxide, polyethylene glycol 400, polyethylene glycol 400 monostearate, propylene glycol, glycerin, ichthammol, phenol, and tannic acid.

Several antiseptics which were mixed with bacitracin in three ointment bases exhibited different action in the different ointment bases, and no conclusions regarding their effect on the activity of bacitracin was reached. The effect of ammoniated mercury, boric acid, sulfathiazole, sulfur, mercury bichloride, coal tar, resorcinol, and benzoic and salicylic acids on the activity of bacitracin must be considered separately for each ointment base.

88 pages. \$1.10. MicA54-3039

THE EFFECT OF VARIOUS PRESERVATIVES ON MICROORGANISMS ISOLATED FROM DETERIORATED SYRUPS

(Publication No. 9560)

Jerome Schimmel, Ph. D.
University of Florida, 1954

The purpose of this investigation was to study the action of various chemical preservatives on microorganisms isolated from deteriorated syrups, with special emphasis on the effect of using mixtures of the esters of *p*-hydroxybenzoic acid.

Eight chemical preservatives and twenty-six different mixtures of the *p*-hydroxybenzoates were tested. *o*-Phenylphenol was the most active against the molds and yeast, and benzyl *p*-hydroxybenzoate was the most active against the bacterium. A definite

potentizing action was found with mixtures of the p-hydroxybenzoates. A mixture of the methyl, ethyl, propyl and butyl esters (70-10-10-10 w/w) showed the greatest potentiation against the molds and the yeast. A mixture of the methyl, ethyl and butyl esters (10-10-80 w/w) showed the greatest potentiation against the bacterium.

Storage tests in Syrup, U. S. P., showed that o-phenylphenol at a concentration of 1:15,000 and

propyl p-hydroxybenzoate at a concentration of 1:5000 were the most promising of the single preservatives tested. Mixtures of the p-hydroxybenzoate exhibited a definite potentizing action. A mixture of the five esters (15-15-15-15-40-w/w) at a concentration of 1:7500 showed the lowest effective minimal preservative concentration of the various mixtures tested.

128 pages. \$1.60. MicA54-3040

HISTORY

HISTORY, GENERAL

HENRY ADAMS AND HISTORY

(Publication No. 8539)

Edward Allan Chalfant, Ph. D.
University of Pennsylvania, 1954

Supervisor: Dr. Robert E. Spiller

The dissertation is an account of Henry Adams's principal endeavors, his career in history and his late career as a teacher and a teacher of teachers. The narrative begins at the moment in 1861 when it was first suggested to Adams, in such a way as to make him try, that he should undertake a serious historical investigation. It ends with his death in 1918.

The account involves close examination of a large proportion of his writings, showing when and how they were conceived and written, the purposes they were intended to serve, the steps Adams took to encourage or discourage their circulation, and the important ideas they convey. These works include: two of his early essays; his lives of Albert Gallatin, John Randolph, and Aaron Burr; his History of the United States of America during the Administrations of Thomas Jefferson and James Madison in its original and its published versions; "The Tendency of History" and "Count Edward de Crillon"; the Memoirs of Arii Taimai; his discarded essay, "The Rule of Phase Applied to History"; and the works of his "series," Mont-Saint-Michel and Chartres, The Education of Henry Adams, and A Letter to American Teachers of History.

The first chapter concerns his initial exploit in history, his essay "Captaine John Smith," which he thrice significantly revised. The chapter illustrates his remarkable aptitude for historical research and his reluctance early in life to become a professional historian.

The second chapter sketches his deep involvement in certain of the most besetting scientific problems of his day, his reaction to Lyell and Darwin, his association with the American geologists of his own generation, and his interest in making history in a new sense a science.

The third, fourth, and fifth chapters form a narrative of Adams's effort to make a successful, systematic survey of a familiar portion of history and produce a scientific historical work of momentous proportions. Attention is given to works he wrote along the way and to his scheme to make himself a well-known, even popular, author. The least familiar important aspect of his life, the partial suppression of his History, is dealt with in considerable detail.

The sixth chapter sets forth Adams's "principles," the system of historical conceptions conveyed by his History. It is maintained that this system is Adams's chief intellectual achievement, that he never afterward changed his views, and that the same system underlies his later works. Part of his system is a theory of the historical evolution of new human types. Secondly, the chapter is intended to make the History more available to his readers.

The seventh and eighth chapters, pausing first to explain the damage done to Adams's reputation after his death by the publication of certain of his works in strange and misleading forms, provide an account of his excursion into Tahitian history and then of his new career as a teacher. The eighth chapter reviews his important late works, especially his Letter to American Teachers of History, which has been rather generally misunderstood, and summarizes his work.

The dissertation controverts several leading assumptions about Adams: that his characteristic ideas occurred to him late in life, that his interest in science was avocational, that he was a pessimist, and that he thought history subsidiary to physics. It is sympathetic to Adams, though not uncritical, and takes him seriously, as a man of phenomenal vigor, ability, and intelligence.

418 pages. \$5.23. MicA54-3059

HISTORY, MEDIEVAL

THE PLACE OF THE BOROUGH IN ENGLISH
ADMINISTRATION DURING THE TWELFTH
AND THIRTEENTH CENTURIES

(Publication No. 9789)

Charles Robert Young, Ph. D.
Cornell University, 1954

This thesis examines the administrative responsibilities of the English borough as recorded in the pipe rolls, the chancery enrolments of the thirteenth century, and various less extensive sources. Once burgesses had obtained the *firma burgi*, the king and his ministers found it convenient to assign a wide variety of administrative responsibilities to borough officials, with the provision that expenses incurred while carrying out royal mandates would be deducted at the exchequer accounting.

The financial responsibilities of the borough included both the collection and the disbursement of royal revenues. Beginning with the pipe rolls, there is evidence of fines offered by burgesses in lieu of tallage; the administrative duties involved in collecting such money fell upon the burgesses. Taxes on movables were also collected at times by borough officials within their jurisdictions. As early as the pipe rolls of the twelfth century, burgesses had some part in collecting prises and customs duties, and the later sources contain evidence of burgesses being elected to provide personnel for collecting customs under one system in 1203 and another, more permanent, system after 1275. Financial policies such as coinage regulations were enforced by borough officials. The full scope of the system for using borough officials to make disbursements at the king's command in meeting royal expenses is shown in the pipe rolls and, from a different viewpoint, in the chancery rolls.

Responsibility of the borough in the administration of royal justice was clearly in evidence during both the twelfth and thirteenth centuries. These responsibilities included: collection of amercements, presentation of cases before the itinerant justices, election of coroners to keep crown pleas, provision of inquisition juries, execution of royal judicial decisions, and establishing seisin in land or other property.

The military contribution of the borough included some participation by burgesses in royal armies, but the borough was more important in providing supplies for these armies. Payments to garrison troops were made by some boroughs. Widespread grants of murage in the patent rolls after 1220 are tabulated as an appendix to this thesis and they show that the borough was valuable to the crown as a military stronghold. The naval contribution of the English boroughs was more important; ships were regularly provided by the Cinque Ports and other boroughs throughout the period. A second method of raising a royal fleet was by the impressment of merchant vessels, and these impressments were carried out by borough officials.

Borough officials were used extensively for the regulation of commerce, especially in the thirteenth

century. Prohibition of certain exports were also enforced by these officials. For political reasons or as retribution for English merchants mistreated abroad, the king sometimes ordered the arrest of foreign merchants, and borough officials were employed in executing such orders. Borough officials also exercised some control in the king's name over sales in the market.

Purveyance was the most important among the miscellaneous responsibilities of the borough. Other services provided the king and royal administration were: transportation services, acting as royal agents in a variety of business, proclaiming the king's ordinances, and giving advice on a variety of specific questions. With the inclusion of borough representatives in various parliaments after 1265, the burgesses also had an opportunity to influence royal policy, as well as to administer it. The burgesses had been trained quite unintentionally for sharing in the government by performing the administrative tasks assigned to the borough by kings and royal ministers during the preceding years. 354 pages. \$4.43. MicA54-3054

HISTORY, MODERN

FIFTY YEARS OF ISTHMIAN-AMERICAN
RELATIONS: AN ANALYSIS OF THE
CAUSES JEOPARDIZING ISTHMIAN-
AMERICAN FRIENDSHIP

(Publication No. 10,139)

G. A. Anguizola, Ph. D.
Indiana University, 1954

This thesis deals with fifty years of relations between the United States and the Republic of Panama. The author attempts to demonstrate that while the United States has itself benefited from the Canal enterprise, strategically, economically and politically, little attention has been given to the fact that the resident of Panama, in spite of his wholehearted cooperation in the Canal enterprise, has not yet fully participated in the benefits accruing from it.

In the course of the nine chapters, the author reviews Isthmian-American relations from the moment Panama was born as a national state. Much of the misunderstanding between the two countries is attributed to the dual and opposite interpretations given by Panama and the United States to the meaning of the articles of the Canal Treaty of 1903, and, after the ratification of the Treaty of 1936, to the violations with which Panama has charged the United States of this later protocol.

In this dissertation it is demonstrated that, since the country is located in the center of a great trade route, the main asset of those who inhabit the Isthmus is trade and commerce. Consequently, early in 1904 the Panamanians began to view the establishment of American owned trade monopolies in the Canal Zone

as a threat to their own business interests. This fact, added to the frequent occupation of land outside the Canal Zone and to American intervention in Panamanian internal affairs, increased ill will on the part of the Panamanians against the United States.

In support of these contentions the author reviews the social, political, economic and racial problems which have formed a background for the Canal enterprise. The progressive influence of the United States in Panama particularly, and indirectly throughout Central and South America, because of the Canal, are recognized in this work. However, much of the blame for misunderstanding between the two countries is placed on bad government in Panama and on the lack of tact of the United States through the Department of the Army and the Canal officials.

It is the belief of this author that the 50th anniversary of the opening of the Canal works by the Americans as well as the semi-centennial celebration of the Panamanian State, offer an opportunity to reexamine the Isthmian Question from a wider scope, through a reappraisal of the American traditional proconsular policies toward Panama, through a consideration of the social and economic changes that have taken place in the United States and throughout the world, and through a true rededication of the Isthmian people to the principles of Democracy, which have been lacking in their fifty years of independence.

437 pages. \$5.46. MicA54-3041

**SOCIAL VIEWS REFLECTED IN OFFICIAL
PUBLICATIONS OF THE CUMBERLAND
PRESBYTERIAN CHURCH, 1875-1900**

(Publication No. 9931)

Milton L. Baughn, Ph. D.
Vanderbilt University, 1954

In the period 1875-1900 American Protestantism was faced with numerous problems created by modern science and scholarship and by rapid social change. This study analyzes the reactions of Cumberland Presbyterians, as reflected in the official Church publications, to some of those problems.

In their reactions to the Darwinian theory of evolution Cumberland Presbyterian writers may be divided into three groups. Conservatives, tending to regard all modern science with suspicion, completely rejected the theory, stated that it never could be reconciled with the Bible, and presented many ingenious arguments against it. Moderate compromisers questioned the theory's validity but recognized the necessity of adjusting theology to established facts of science. Liberal compromisers accepted evolution as established and reconciled it with their theological beliefs. Opposition to the higher criticism was widespread, and in the 1890's the editors of the Cumberland Presbyterian weekly paper stopped publishing discussions on its findings, despite some criticism from members of the Church.

Cumberland Presbyterian comment on the problems of industrial society was largely editorial and

falls into three stages. From 1875 to 1883 the publications reflect little interest in contemporary issues except for a mild censure of capitalists for paying low wages and for working their employees on Sunday. Between 1883 and 1895 editors and some contributors displayed attitudes usually associated with the Social Gospel in its formative stage. Although they rejected socialism they contended that the capitalistic system should be reformed to insure a more even distribution of wealth. As practical remedies for industrial strife they suggested such devices as arbitration, co-operatives, and profit-sharing. They sympathized with the worker but feared that organized labor would become as tyrannical as capital had been. Holding society partly responsible for poverty and crime, they advocated the principles of the new humanitarianism and the new evangelism, insisting that the only real cure for social and economic ills was the application of the Golden Rule to all affairs of life. During the last five years of the century the publications included little comment on these problems, although the editors expressed some sympathy toward labor and antipathy toward "trusts." Occasional articles reflected traditional laissez-faire doctrines.

The General Assembly of the Church took an active interest in temperance and prohibition. It moved from general encouragement of the movement and recognition of the right of the state to regulate or prohibit the liquor traffic to a firm stand for state and national constitutional prohibitory amendments. Members used the publications to advocate prohibition and to disseminate temperance sentiment through a variety of propaganda devices. Many writers applied temperance sentiment to the use of tobacco and attempted to discourage it, but the General Assembly, although considerably agitated by the question, never adopted a severe censure of tobacco.

Cumberland Presbyterians condemned such political evils as vote fraud, character assassination, and bribery which resulted from extreme partisanship and insisted that Christian citizens could reform politics. They suggested legal reforms to restore public confidence in the courts and to eliminate the disgrace of mob rule. Sabbatarians decried the increasing secularization of the Sabbath and beginning in the late 1870's the General Assembly frequently spoke out against Sabbath desecration. Church spokesmen advocated continuance of the "open arms" immigration policy, although they insisted that Chinese immigration should be restricted and undesirable European immigrants barred. They maintained strict Victorian standards on traditional moral questions, condemning such "worldly" amusements as dancing, the theater, "church fairs," and many sports.

In general, Cumberland Presbyterian social views apparently were in accord with prevailing Protestant attitudes, especially with those of church members in the south and midwest.

278 pages. \$3.48. MicA54-3042

**EMPIRE IN WOOD: A HISTORY OF THE
UNITED BROTHERHOOD OF CARPENTERS
AND JOINERS OF AMERICA**

(Publication No. 9739)

Robert A. Christie, Ph. D.
Cornell University, 1954

This thesis studies the evolution of the union's structure in response to changes in the building industry's market structure, organization, and technological development.

National unity was forced upon the various locals in 1881 by an industrial revolution in the woodworking industry which took some carpentry work into planing mills and made it easier for contractors to subdivide the remainder among piece workers. The threat, however, was not considered great enough to force the carpenters to form more than a weak federation. The national officers received only the power to collect and disburse a strike fund and to issue a working card.

The one thing the union most needed, organization, was founder Peter McGuire's greatest talent. He organized in order to gain socialist goals. The carpenters were willing to be organized for practical reasons, and the two found common ground in the eight-hour movement of 1886-1890. Its success assured the union's continued existence.

With the end of the eight-hour movement, the Brotherhood's organization-federation phase also ended, and the growing union should have been centralized. Although reforms were made in 1890, McGuire refused to countenance the necessary degree of centralization, and set the stage for his dismissal.

The specific cause of McGuire's dismissal was his failure to adjust the union's jurisdiction to a second industrial revolution, which occurred in building construction techniques. This revolution subdivided the craft, giving some of its work to new trades and still more to mill machines. Yet McGuire refused to engage in interunion jurisdictional disputes because of his socialist ideals. The local leadership (business agents whose tenure was based on ability to protect and preserve the carpenter's craft) took exception to McGuire's policy. Originally created to protect the craft from the non-union piece worker, when the industrial revolution threatened the craft's existence they had to provide the same protection from other unions. When McGuire refused to help them provide this protection on the national level, the business agents deposed him in 1902.

Between 1902 and 1920 the new leaders centralized the union's structure. Nationally the Executive Board, which had balanced the power of the President, was made subordinate to the President. The President was given power to regulate all local affairs, particularly in jurisdictional matters. Finally, an extra-constitutional machine of professional organizers was created to link the local and national officers. These organizers discovered when and where the carpenters' self-assumed right to work on all materials made of, or once made of, wood, was being flaunted. They then coordinated the efforts of the

various district councils with those of the national office to put an end to the encroachment.

Jurisdictional considerations also changed the union's policy during these years. To pursue their jurisdictional policy the Carpenters created, outside the AFL, the Structural Building Trades Alliance, forcing Gompers to create the Building Trades Department. In 1911, the Carpenters forced the AFL to abandon strict craft unionism and to adopt a one-organization-for-one-trade policy, by turning two full unions, the Amalgamated Carpenters and the Amalgamated Woodworkers, over to the Brotherhood. In 1914, the newly acquired woodworkers were deprived of voice in the union to guarantee that they might not overwhelm their carpenter rulers.

By 1920, the union's structure, which has changed but little today (1954), was completed. The history since 1920 deals with the leaders' struggle to defend the jurisdiction from the assaults of other AFL unions, CIO unions, National Labor Relations Board elections, and, finally, the Federal courts.

612 pages. \$7.65. MicA54-3043

**THE BEGINNINGS OF THE ITALIAN
SOCIALIST PARTY (1890-1900)**

(Publication No. 10,174)

John Alexander Butler Faggi, Ph. D.
Columbia University, 1954

Italy's Socialist Party dates from 1892. Until 1900 it remained a small section of (mostly Central and Northern) bourgeois and petit-bourgeois opinion which desired to orient Italy's proletariat towards Marxist goals.

The movement's leaders, predominantly bourgeois professionals, proclaimed their loyalty to the ideals of international Socialism. However, they became absorbed in the problems - economic, political, intellectual - and, as they said, "moral" - which had been made apparent by Italy's tardy unification. They resembled, thus, crusading missionaries preaching national redemption, condemning the poverty, backwardness and political sterility of their fatherland. They offered solutions for Italy's problems, not as Internationalist-Socialists, but as Italians with a national conscience. To the extent to which these Socialists became absorbed in national problems and disregarded the future stateless world, they became patriots - in fact, "nationalists."

The forerunners of Italian Marxist Socialism contributed a mixed tradition. Mazzinian republicanism, Bakunin's Anarchism, and Milanese laborite socialism flowed into the main stream of Marxism which was growing slowly in the 1870's and 1880's. These decades witnessed abortive efforts, by Anarchists, and Milanese labor groups, to form parties. The late 1880's and early 1890's saw a growing body of Marxist intellectuals, including Turati and Mme. Kuliscioff, who broke permanently with the Anarchists in 1892 to form the Socialist Party.

The Party created a centralized organization

stressing discipline and independent political action. Efforts were made to "educate" the lower classes. An active local and national press and propaganda campaign, and continuous electioneering and labor organization characterized Socialist efforts. Between 1895 and 1900 Socialist deputies increased from 12 to 32. The movement continued to recruit some of Italy's best minds. The *Critica Sociale*, edited by Turati, disseminated intellectual Socialism, acquiring a deserved reputation for excellence.

Italy was plagued, in the 1890's, with economic malaise. Europe's "Long Depression" in prices, culminating in the late 1890's, was coterminous with a purely Italian depression. A tariff war with France reacted adversely on Italian agricultural labor by depriving many food and wine industries of a traditional export outlet. Bread prices soared. Riots amounting to near-revolution broke out in Sicily in 1894, and in 1898 mob violence flared up from one end of the peninsula to the other. The Socialists were accused of fomenting the trouble in both instances and in both 1894 and 1898 the Party was repressed and many of its leaders were imprisoned.

In the Chamber the Socialists demonstrated a cohesion and discipline unfamiliar in Italian politics. They came to make a common cause with the Radicals and Republicans - an alliance known as the *Estrema Sinistra* (Extreme Left). After the crisis of 1898 the government took increasingly repressive action and in 1899 threatened freedom of press and assembly. This was met with parliamentary obstructionism by the *Estrema*. The ensuing contest ended in victory for the latter in the June elections of 1900 and in the resignation of the Conservative Ministry. Meanwhile the Socialists continuously attacked governmental imperialist and Great Power policy, insisting that Italy strive to be a progressive small power rather than a weak great power saddled with a heavy military budget.

The 1900 Socialist Congress launched the Maximum and Minimum Programs, the latter listing immediate reforms possible within the limitations of the state. An important debate developed over the question of Party electoral cooperation with progressive, non-Socialist parties. One faction ("intransigents") insisted on non-cooperation; the other, including Turati and his "Milan group," advocated alliances when these should be beneficial to Socialist interests. This latter faction ("autonomists") prevailed. The next decade was to see this difference of opinion widen so that there was no real unity in the Party by 1914.

217 pages. \$2.71. MicA54-3044

THE ROLE OF ABDULLAH IBN HUSAIN,
KING OF JORDAN, IN ARAB POLITICS,
1914-1951: A CRITICAL ANALYSIS OF HIS
POLITICAL ACTIVITIES

(Publication No. 9495)

Werner Ernst Goldner, Ph. D.
Stanford University, 1954

Arab history of the first half of the twentieth century has been the story of the growth and the development of Arab independence. Abdullah ibn Husain of the family Hashim of the house Quraish saw in his life-span of sixty nine years - from 1882 to 1951 - the "Arab Nation" liberated from Turkish domination and established as independent Arab states. During the last forty years of his long life he has taken an active part in the shaping of Arab history. His role in Arab politics has been controversial; he has been hailed as a patriot and condemned as a traitor.

His political career reflects the development of Arab history in those fateful years of growing Arab independence. He was in succession: Deputy for Mecca in the Ottoman Parliament; conspirator against the Turkish empire; planner and military leader in the Arab Revolt; rebel against French authority in Syria; ruler of Transjordan under British mandate; king of the independent kingdom of Jordan.

Three factors determined Abdullah's thinking and actions throughout his long political life:

He believed himself to have the indisputable right to leadership in Arab affairs. This right he derived from his descent from the greatest Muslim dynasty, the house of the Prophet. He regarded himself, moreover, as the oldest surviving son of King Husain of the Hijaz, as the heir to the promises Britain had given in 1915 to his father.

He had an unshakable faith in British friendship and justice. He believed throughout his life that Britain would fulfill her promises to the Arab people. For this reason he remained loyal to Britain even in adversity and in spite of numerous political differences. This loyalty earned Abdullah the trust and the support of his British allies.

He had one supreme goal for which he planned and worked consistently throughout most of his political career. This goal was the creation of "Greater Syria," the unification of the divided parts of geographical Syria - Syria, Lebanon, Transjordan, and Palestine - into one single Arab state under his rule.

His loyalty to Britain earned him, in turn, the distrust and the hostility of Arab nationalists who saw in this loyalty only subservience to foreign interests. His plans for "Greater Syria" were opposed by potent Arab forces. Particularism, the ambitions of political leaders in Syria, Lebanon, and Iraq, jealousies of the ruling houses of Egypt and Saudi Arabia combined to prevent the realization of his goal, which would have increased the power and the prestige of the Hashimite dynasty.

That he was unable to attain his goal, his "Greater Syria," was the tragedy of his life.

332 pages. \$4.15. MicA54-3045

A HISTORY OF GAINESVILLE, FLORIDA

(Publication No. 9548)

Charles Halsey Hildreth, Ph. D.
University of Florida, 1954

A History of Gainesville, Florida, traces the growth of a town from its establishment in 1854 through its first hundred years. Since local history reflects the national and international scene, the development of Gainesville is related to the larger scope of history in the world around the city. Special attention is given to the development of social and economic institutions as well as the more conventional political items of historical interest inherent in the story of a locality.

A variety of source materials were used in making this study. The minutes of the City and County Commissioners, the records of the City Director of Finance and the County Clerk were most valuable. Personal papers, journals, and diaries provided detailed accounts of episodes in Gainesville's history. Public documents of city, state, and nation, such as special city reports, legislative journals, census returns, departmental reports, and the findings of special committees were rich sources of information. Although no complete file of a single newspaper covers the one hundred years, the Gainesville Daily Sun, together with twenty-nine other daily and weekly journals gave adequate newspaper coverage of the city. Personal interviews supplied leads to important events and added intimate accounts, but the information gained by personal contact was carefully evaluated and used only when supported by other evidence. Secondary sources used included articles in journals, monographs, pamphlets, trade journals, master's theses, and local histories.

Gainesville was established as a by-product of national railroad building in the mid-nineteenth century and for fifty years the town was a shipping and service center for agricultural products, naval stores, and phosphates. During this period Gainesville was retarded by the Civil War but located as it was in a frontier area, recovered rapidly and by 1900 was a semi-rural community of 4,000 inhabitants. The real growth of the town began in 1906 with the coming of the University of Florida, and since that date Gainesville's development has been tied to the fortunes of the University. Similar to other urban places, the town faced many problems in providing streets, water, electricity, and other public services for its citizens. These problems were never solved, for additional population made old problems more acute and added new ones. Inadequate past planning increases the difficulties confronting Gainesville, which is now in transition from town to city.

307 pages. \$3.84. MicA54-3046

BRITAIN AND THE U.S.S.R., MARCH-SEPTEMBER 1939: EMERGENCE AND DISSOLUTION OF ENTENTE HOPE

(Publication No. 9690)

Jack Homer Howe, Ph. D.
University of Nebraska, 1954

Advisor: Albin T. Anderson

One of the most crucial periods in world history was the six months' interval from March to September 1939. For Great Britain this was a period of experimentation in foreign policy in an attempt to adjust to the definite threat of totalitarian hegemony in Europe. The previous year's efforts to appease Germany were discredited by Hitler's seizure of the remnant of Czechoslovakia on March 15. The resulting popular outcry in Britain forced Prime Minister Chamberlain to reappraise his foreign policy.

Chamberlain yielded to pressure to the extent of guaranteeing the integrity and independence of Poland, Greece and Rumania, of negotiating for a treaty of alliance with Turkey, and of seeking the services of the Soviet Union in the defense of eastern Europe. The last of these steps was of the utmost importance, for the U.S.S.R. seemed to hold the key to the preservation of peace. With the Soviet Union firmly tied to the western democracies, either Hitler would not dare attack Poland for fear of becoming involved in a real two-front war or, if he did attack, Poland or Rumania could be successfully reinforced.

The ensuing negotiations between London and Moscow continued from April 17 (when the Russians offered a reciprocal military alliance) to August 23 (when they signed a non-aggression pact with Germany). The course of these protracted discussions was characterized by delay and hesitation on the part of the British, by a refusal to compromise on the part of the Russians, and by mutual suspicion.

The British suspicion of Russia was in part the Conservative fear of Communism. Even more it was probably based on an underestimation of Soviet strength and a distrust of Russian motives in respect to eastern Europe. On their part, the Russians felt that Britain secretly wished them embroiled in a war with Nazi Germany while Britain remained aloof. Likewise, the Kremlin had no faith in the British Government's resolve to maintain its guarantees of eastern European countries and was quick to note any indication of a reversion to appeasement.

Britain carelessly supplied such incidents during the summer of 1939. Her policy in respect to the lesser Axis Power - Italy - continued to be extremely conciliatory, as was her handling of France. A variation on the 1938 policy that might be called neo-appeasement appeared by summer in Britain's dealings with Germany, and Anglo-German talks as well as the backstage diplomacy of Herr Dahlerus were important indications that British policy towards Germany was not so firm as its spring pronouncements might have indicated. The course of the Anglo-Soviet talks in Moscow was thus impeded by mutual suspicion that seemed justified on both sides. By the time

Moscow commenced insisting that military discussions should precede conclusion of the political agreement, there was little hope for a successful termination of the negotiations.

Much has been written concerning the perfidy of the Soviet Union during 1939 and little exception can be taken with any of this. It has been the purpose of this study, however, to examine the British aspect of these negotiations on the basis of the new volumes of Foreign Office documents which have recently been published. From such research, it would appear that Britain as well as the U.S.S.R. must share responsibility for the collapse of the negotiations. Particularly during the last few weeks of the discussions, British good faith can be questioned. The Foreign Office seemed to be using the negotiations for their immediate effect rather than for the ultimate end they were supposed to serve.

440 pages. \$5.50. MicA54-3047

A HISTORY OF AMERICAN MEDICAL ETHICS, 1847-1912

(Publication No. 9186)

Donald Enloe Konold, Ph. D.
University of Missouri, 1954

The American Medical Association adopted an elaborate "Code of Ethics" at the time of its organization in 1847. Following repeated attacks on the doctor and his privileged status during the democratic upsurge of the 1830's and 1840's American physicians promoted ethical regulation to enhance their profession's prestige and win respect for its individual members. As the century progressed they tried to use ethics to destroy all forms of quackery, to bolster their professional status, to encourage lay confidence in their ability, and to promote their financial prosperity.

During the third quarter of the century the organized profession regarded the "Code of Ethics" primarily as an instrument for combatting quackery. Medical societies urged physicians to improve their ethics, and thereby distinguish themselves from impostors whose methods would not stand scrutiny. To many practitioners, however, the ethical campaign against quackery was important largely because it provided means for improving their own conduct. Efforts of medical societies to police their members produced dissension and antagonisms, but failed to turn public opinion against quacks.

As long as ethical definitions of quackery prevailed, poorly-trained doctors enjoyed honorable standing. Through most of the nineteenth century the profession insisted that ethics was more important than skill or knowledge, and as a result most physicians decried scholarship, specialism, and scientific leadership in general.

During the last quarter of the nineteenth century scientific leaders revolted against the system of ethical regulation. They secured medical laws barring the unqualified from practice, overcame prejudices

against research and specialism, and encouraged their colleagues to become competent as well as honorable.

At all times physicians attempted to subject laymen to their authority in medical affairs. They demanded the confidence of their patients, and urged obedience as well. They tried to dictate medico-legal opinions to the courts. As the public health movement developed after the Civil War, they also tried to dominate it.

Ethics demanded that physicians conceal differences of opinion from laymen, in order to uphold the profession's dignity. By the end of the nineteenth century physicians not only withheld criticism of each other but also concealed evidence of professional bungling. In order to prevent even the least competent from falling into disgrace, medical societies defended their members against malpractice charges.

Physicians acknowledged the professional ideal of disinterested public service, but they insisted that the profession's prosperity was fundamental to its ability to serve. Medical leaders condemned the rise of contract practice after the Civil War, because its cheapness threatened to reduce professional income. Local societies blacklisted patients who did not pay, established fee bills which forbade underbidding, and approved overcharges wherever they were practical. In the twentieth century the profession adopted the business man's bookkeeping and bill-collecting techniques. It forbade underhanded methods of making money - unnecessary operations, rebates, fee splitting - but was not spectacularly successful in enforcing these prohibitions.

In 1903 the American Medical Association abandoned its machinery for enforcing ethical regulation, in the hope that physicians would conform voluntarily. After this experiment failed, the Association devised a new code which re-established strict ethical control in 1912. In spirit and content this new instrument was much like the original code of 1847. The principal differences centered around the elimination of archaic provisions and obscure phraseology. The 1912 code, which is still in effect, stands as a symbol of the survival of the ethical tradition into an age of scientific medicine. 286 pages. \$3.58. MicA54-3048

A BIOGRAPHY OF FRANK KNOX

(Publication No. 9101)

George Henry Lobdell, Jr., Ph. D.
University of Illinois, 1954

Frank Knox (1874-1944) was primarily a journalist-businessman, and secondarily a politician. This biography is a chronicle of his public life in these two roles.

The publisher of the Grand Rapids Herald hired Knox as a reporter after reading some of his letters describing his Rough Rider experiences. Knox soon became city editor and then circulation manager of the Grand Rapids paper. In 1902, with his printer-

partner, John Muehling, he bought a newspaper in Sault Ste. Marie, Michigan. After a year of careful business management and aggressive publishing, the partners drove all competition out of business. In 1912, Knox and Muehling sold their Michigan paper and moved to Manchester, New Hampshire. Within nine months, Knox established a new newspaper monopoly by buying out his chief competitor, and for the next fourteen years he gave varying attention to the successful publishing of his two Manchester papers. In 1927, Knox's abilities attracted Hearst's attention, and Knox was hired to publish Hearst's Boston papers. He resigned this position in December, 1930, after disagreeing with Hearst on management policy. The next year, Knox climaxed his newspaper career with the purchase of the Chicago Daily News. By careful management during the depression, he accomplished the difficult feat of keeping the Daily News on a profitable basis without eroding its qualities as a newspaper. Knox's newspaper career was outstandingly successful.

Knox's first significant political activity came in 1910 when he managed the winning primary and gubernatorial campaigns of Chase Osborn. After these victories, however, he was never again successful in politics. His Rough Rider heritage brought Knox into the circle of Theodore Roosevelt's political lieutenants in 1911 and 1912. Knox did significant work as a Roosevelt political manager in the midwest. A split in the Michigan Republican part and another split in Progressive ranks left Knox without political power and encouraged him to leave Michigan. In New Hampshire, he left the Progressive party to become a regular Republican again. In 1920, he was chairman of the New Hampshire delegation to the Republican National Convention and a floor leader for the losing Wood forces. In 1924, he was defeated by John Winant for the New Hampshire Republican gubernatorial nomination and abandoned active politics for ten years. Knox became a caustic critic of the New Deal and as such aspired to the Republican presidential nomination in 1936. He lost first place to Alf Landon but was nominated vice-presidential candidate. In the election that followed, Landon and Knox were overwhelmed by Franklin Roosevelt. In spite of these failures, Knox's life closed while he was serving in a political post: Secretary of the Navy. Knox had supported FDR on foreign policy and when foreign affairs overshadowed domestic affairs in 1940, Knox accepted the Navy portfolio in Roosevelt's cabinet as a patriotic duty. He gathered around him an unusually competent group of civilians, and after Pearl Harbor, he had the most competent Navy men in key military posts. With this support, he administered his office ably during the Navy's most critical days of expansion and battle. 377 pages. \$4.71. MicA54-3049

FRENCH SOCIALISM: ITS RESPONSE TO
THE GROWING THREAT OF FASCISM
AND WAR, 1933-1936

(Publication No. 9765)

John Theodor Marcus, Ph. D.
Cornell University, 1954

This study is an investigation of the consolidation of divergent convictions and policies in the French Socialist Party as a consequence of the advent of Hitlerism in Germany. It is concerned with the changes that occurred in a traditionally pacifist movement as the danger of European war increased.

The initial reaction of French Socialists to the drastic collapse of the German Social-Democratic Party was a marked shift to the left. Thus the Party's center joined the revolutionary left wing in calling for an intensification of the class-war as the only way to forestall fascism in France. On the contrary, the right wing of the Section Française de l'Internationale Ouvrière (S.F.I.O.), claimed that the only effective way to stop the expansion of Hitlerism was by the creation of a wide anti-fascist front with the left-bourgeois Radical Party. An important faction of the right wing even adopted pseudo-fascist concepts of Nationalism and Authoritarianism in its desire to win over the middle class. By November of 1933, these divergences had widened into an actual schism. The S.F.I.O., now deprived of most of its reformist element, moved still further to the left.

The events of 6 February, 1934, and the growth of a mystique among the French left that a fascist coup d'état was imminent, continued to push the Socialist Party in the same extremist direction, and eventually into a "Pact of Unity" with the Communists. The manner in which this agreement came about indicated that the leadership of the S.F.I.O. had lost the effective control of its Party to a faction of extremists exerting pressure directly upon the militants. This was a veiled but serious portent for the future.

The outcome of the general evolution of French socialism during 1933 and 1934 was that by the following spring, the S.F.I.O. had been brought to a fierce hostility against any collaboration with supporters of the French "capitalist state" and to a particularly bitter animosity towards the military policy of the Government. Though the extreme doctrine of "revolutionary defeatism" had not become the plan of the center majority, nonetheless, this idea had grown until it became the sentiment of an important minority, a minority that significantly influenced the decisions of the majority itself.

It was at this point - in the spring of 1935 - that the French Communist Party executed a startling reverse. In obedience to a declaration by Stalin, it suddenly came out in favor of a strong military policy against Germany and called for the formation of a broad anti-fascist front. The previous evolution of the Socialists had brought that Party to a position where it was not isolated in semi-revolutionary opposition, and outmaneuvered by its enemy. The confusion in socialist ranks came to a climax. The revolutionary wing which had demanded both union with

the Communist Party and a class policy of revolutionary pacifism split between those who, adhering to the first principle, followed the communists, and those who, still advocating the second, pursued their own policy of isolated extremism. The Party leadership and the center majority were equally stunned by the new line of world communism. The S.F.I.O. itself had been trapped in the impasse of its ineffectual revolutionist-pacifist verbalism.

Eventually, the effect of the Communist switch was to draw the Socialist Party, reluctantly and slowly, back again to its original acceptance of national defense. But by that time, the S.F.I.O. had lost its individuality. It had lost the political initiative, the central position it had held in 1933 as the natural "unifier" of both the proletariat and the bourgeois-left. Above all, it had lost immeasurable prestige through its inability to lead the French left in a cohesive resistance to national-socialism. After Munich, these divisions among Socialists on the primordial question of national defense against Hitler were to reappear with greater intensity and to paralyze the action of the Party.

At the same time, the vacillations of the Socialists had enabled the Communists to pose as the patriotic party of the left and the leader of the anti-fascist forces in France. The decisive advantage which this claim has afforded the French Communist Party over the years among the elements of the French left can thus be traced to the failure of French Socialism during the formative years of its response to the nationalist-socialist challenge.

290 pages. \$3.63. MicA54-3050

THE GERMAN PEOPLE OF NEW ORLEANS, 1850-1900

(Publication No. 9956)

John Frederick Nau, Ph. D.
University of South Carolina, 1954

New Orleans, founded by the French in 1718, became one of the important ports of the United States during the nineteenth century. As such, it attracted European immigrants of all nationalities, some of whom used the city merely as a port of entry, others, as their home in the new world. Those who remained contributed to the culture of the city, a culture which was predominantly French, Spanish, and American.

In spite of the prevailing French and Spanish culture, other European immigrants contributed to it and left their influence. Among these were the German people. As early as 1721, they came to Louisiana to find a more promising future. Again and again they came, until in the 1850's New Orleans counted more than 14,000 German-born among its citizens. While the number gradually decreased after 1865, there always remained an expressive group which contributed to the unique cultural life of the city.

This dissertation has been based upon a study of the writings of J. Hanno Deiler, who from 1873 worked unceasingly to foster the culture of the

German in New Orleans; the numerous booklets and pamphlets advertising New Orleans as a center of commerce and industry, in which the Germans played a vital role; and the minutes and records of numerous German institutions, such as, churches, benevolent societies, and charitable organizations. Considerable attention has been given to the German newspapers of the period, particularly the *Deutsche Zeitung*, and to interviews with many old New Orleans Germans who were active in cultural circles during the last decades of the century.

During fifty years (1850-1900), the Germans were caught in currents of political turmoil, were harassed by epidemics, and were buffeted by difficulties in establishing a home. At the same time, they were assisted by others in adapting themselves to new conditions and in contributing to the cultural life of the city.

Contributions came from German doctors, lawyers, musicians, actors, preachers, teachers, businessmen, farmers, dairymen, and domestics. To air their ideals and ideas many Germans ventured into journalism and, to experience the full meaning of *Gemütlichkeit*, into the beer brewing industry. To preserve their Catholic, Protestant, and Jewish faiths, they erected churches, synagogues, and schools; and to express their love for fellowman, they organized lodges, benevolent societies, and eleemosynary institutions.

Prior to 1850, the Germans of New Orleans founded the professional theater, which they continued to support through the 1850's and the 1860's. In the later decades of the century, they concentrated on the amateur stage which flourished in their schools and clubs. Their love for song and sociability was realized through the media of singing societies, family beer gardens, taverns, and outdoor festivals. Observing Christmas, Easter, and New Year's Eve in typical German fashion, they introduced the novel ideas of lighted and decorated Christmas trees and the multi-colored Easter rabbit. At the same time, the gay life of the city reveling in gambling, horse racing, prize fighting, and the celebration of Mardi Gras, was very attractive to many Germans of the town.

Certain German people wrote their names indelibly upon the cultural life. Among these, none were more influential and beloved than Frederick Loeber and William Kohlmann in the field of medicine; J. Hanno Deiler in the field of music and education; Jacob Hassinger in newspaper and finance; Fritz Jahncke in construction; and Gustav Seegers, A. G. Ricks, and Henry L. Frantz in industry.

283 pages. \$3.54. MicA54-3051

A HISTORY OF THE CONSTITUTIONAL UNION PARTY: A TRAGIC FAILURE

(Publication No. 10,187)

John Burgess Stabler, Ph. D.
Columbia University, 1954

The Constitutional Union Party was composed largely of former members of the Whig and American Parties; these two parties had both floundered during the 1850's due to sectional differences on the slavery question. They were given new hope when the Democratic political ascendancy was rudely shattered in 1858 due to Buchanan's foolish attempt to force the admittance of Kansas into the Union with its fraudulent proslavery Lecompton Constitution. Republicans, Americans, Whigs, and some Northern Democrats united in opposition and called for true popular sovereignty in Kansas. Cooperation among these groups in rejecting Lecompton was used by a small group of Whigs and Americans as a starting point to establish a national union of the Opposition to the Democracy. They were encouraged by the successful cooperation of the anti-Lecompton forces in some of the 1858 elections in the North. At a meeting in Washington in December, 1858 they decided to establish a national Opposition Party to defeat the Democracy in 1860.

Leading Southern American newspapers and politicians were also calling for the formation of a national Opposition Party. They were encouraged by gains in the 1859 elections in the Southern border states. Conservative political forces in the North, particularly in New York City, were also trying to promote a national union of the Opposition. However, the Northern elections of 1859 seemed to confirm Republican control of the North. John Brown's raid heightened sectional feeling thus making the formation of a national Opposition more difficult. The Republicans saw no need for a united Opposition if they could win in 1860 without allies and this seemed likely due to the Democratic Party division.

Leadership in the meetings of late December, 1859, which organized the Constitutional Union Party was taken by the Southern Opposition and especially by Senator John J. Crittenden of Kentucky. John Bell of Tennessee was nominated by the new party for President and the reluctant Edward Everett of Massachusetts for Vice-President. The platform pointedly avoided a stand on the important slavery extension question and called for adherence to the Constitution, the Union, and the enforcement of the laws. State parties were formed in all but a few states and a National Committee functioned from Washington. The new party's best chance to elect its candidate was to prevent the Republicans from gaining a majority in the electoral college. Consequently, in several Northern states the Bell Party formed anti-Lincoln coalition tickets with the two wings of the Democratic Party. The party's main campaign argument was that it was the party that could save the Union. Three Southern border states with an electoral total vote of 39 were carried. The party's greatest strength was in the Southern border states where it polled 44% of

the popular vote; in the lower South it polled 33% and in the North, a mere 4%.

The main cause of the failure of the Constitutional Union Party was that the slavery question could not be downed. It did, however, offer a haven and a forum for conservatives on the slavery question who objected to the radicalism of the Republicans and who, because of long years of political enmity could not find their way into the Douglas wing of the Democratic Party. After 1860 the new party disappeared into the political maelstrom that accompanied the Civil War.

Due to its broad appeal and its more than mere sectional strength, the Constitutional Union Party does not fit neatly into the pattern of traditional American third parties. The tragic events of 1861-1865 offer proof of the value of the object of the Constitutional Union Party: the saving of the Union.

754 pages. \$9.43. MicA54-3052

THE WHIG PARTY AND DOMESTIC POLITICS, 1830-1841

(Publication No. 9787)

Franklin Arthur Walker, Ph. D.
Cornell University, 1954

British democratic party politics and the social service state find their origin in the period of the Great Whig Ministry (1830-1841). During these years Whig and Tory leaders established central party headquarters and a network of local organizations to form the Liberal and Conservative parties, while the Factory Act of 1833 and the Poor Law Amendment Act of 1834 acknowledged a principle of paternalism and centralization at variance with *laissez faire* liberalism, but in harmony with modern socialism.

The need to develop national, well-organized parties in place of aristocratic "borough-mongering," and Parliamentary response to the inhumanities of unfettered capitalism are the most arresting features of the 1830's.

A national political party requires able statesmen at the top who can form ministries, and an enthusiastic following in the countryside willing to spend time and money on the details of party organization. Above all the national party needs a "cry" - a simple principle which can unite diverse personalities and appeal to the voter. Both Whig and Tory parties had able statesmen on the top, for such was the chief advantage of the aristocratic structure of society. And both parties had active support on the local level. It was, however, the matter of party principles which offered the chief difficulty.

Soon after the excitement of 1832 had grown cold, it was evident that political demands went far beyond the framework of the old parties. The proletariat looked to a new social order through Chartism; the middle classes wanted free trade in corn; the Dissenters wanted to be free from supporting the Church of England and became increasingly angry with educational restrictions; the Irish Catholic wanted self-government and an end to the privileged position of

the Irish Church; the Tory landowner wanted lower taxes, protection and a favored Church; the City banker wanted a strong government.

Disraeli in 1846 brought to a crisis the basic split in the Conservative party between the financier and the squire. Whigs were even more divided. They looked for support from the middle-classes, but the middle-classes found aristocratic landholders not the best guarantee for a sincere free-trade policy. The Whigs championed the cause of the Dissenters, but were churchmen themselves and besides could make little headway against a Conservative House of Lords. The Whigs needed Irish votes, but the conciliation of Ireland cost them the support of England. The Whigs needed the backing of Radical campaigners. Yet the Radicals, soon disillusioned with the post-1832 electorate, wanted the ballot and an extended franchise, demands which ran counter to the cautious mood of the voter.

In spite of these divisions, both parties built up national organizations, which is a tribute at once to practical political ability on the part of aristocratic leaders, and evidence of the important effect of the Reform Bill. Nevertheless the organization of necessity was slack, and politics as a whole remained in a confused state until the establishment of the more coherent parties of the 1870's.

The social legislation of the 1830's is not to be ascribed to any particular party. Radicals, Tories and Whigs alike supported the Factory Act and the Poor Law Amendment Act. Everyone suspected the centralization involved in the administration of these Acts. But since a stable society demanded efficient solutions to the problems of poverty and factory conditions, the great majority in all parties accepted without much question the necessity for centralization.

367 pages. \$4.59. MicA54-3053

HOME ECONOMICS

YOUNG CHILDREN'S CONCEPTS OF PARENTAL ROLES

(Publication No. 9678)

Helen M. Finch, Ph. D.
Florida State University, 1954

The primary purpose of this study was to identify and compare the conceptions of parental roles held by children from three to seven years of age revealed through the use of three selected techniques - pictorial interview, direct questions, and doll play. It has been suggested that research done in the home environment might possibly reveal truer reflections of the child's attitudes toward his parents than research done in a laboratory setting. Therefore, in an effort to determine the effect of these environments upon the child's responses the present study applied the same techniques for determining the children's conceptions of parental roles in the home and in the laboratory.

Preschool children and their mothers from twenty families where the father followed a profession, as teaching, medicine, or the law, in Tallahassee, Florida served as subjects for this study.

A set of photographs depicting a mother and a father in the following roles was developed: (1) as the person in charge of child caring routines: (a) putting child to bed; (b) bathing child; (c) feeding child; (2) as economic provider; (3) as companion; (4) as religious teacher; (5) as teacher; (6) as source of affection; (7) as housekeeper or cook; (8) as person caring for child during illness; (9) as disciplinarian; (10) as person supplying protection to the child; and (11) as contributor to the species.

The children's responses to the pictures indicated that the children tended to think more frequently of both the mother and father rather than of either alone

as performing ten of thirteen roles presented in the pictorial interview. With very few exceptions the children conceived of only the father as the economic provider and of only the mother as housekeeper and contributor to the species. The fact that all of the mothers included in the study were full time homemakers may have accounted for the overwhelming choice of the father for the role of economic provider. The results of the pictorial interview revealed that boys tended to choose the father significantly more often than did girls. Also, the children tended to choose the father significantly more often in the laboratory than in the home. Both parents were chosen in the home more often than both were chosen in the laboratory. Although statistically significant differences between the children's responses in the home and in the laboratory were found, further studies will be needed to determine which situation is superior as an environment for the study of children's feelings and concepts.

The mothers were asked to predict their children's responses to the pictures in an effort to determine whether the children's conceptions of mother and father roles agreed with mothers' opinions of their children's conceptions. The results revealed there were no statistically significant differences between the children's responses and the mothers' predictions of these responses.

In response to the question "What is mother?" approximately 50 per cent of the responses fell into the category of household duties. About 25 per cent of the responses indicated that the role of the mother was that of caring for children.

Approximately 75 per cent of the responses in answer to the question "What is daddy?" revealed his role to be that of economic provider.

Responses during doll play indicated that the

children tended to consider the mother as performing more roles than the father, particularly those roles related to the care of the children and those pertaining to housekeeping, although there were indications that the father helped in performing both functions. The doll play situation appears to have distinct possibilities as a means of determining children's attitudes and behavior if a satisfactory means of observing and recording spontaneous doll play in both the home and the laboratory can be developed - with the children not being conscious of the observer.

77 pages. \$1.00. MicA54-3055

ATTITUDES CONCERNING THE GUIDANCE
OF CHILDREN: A STUDY OF THE
DIFFERENTIAL EFFECTS OF AN
INTRODUCTORY COURSE IN CHILD
DEVELOPMENT ON THE ATTITUDES
OF COLLEGE WOMEN

(Publication No. 9681)

James Coates Walters, Ph. D.
Florida State University, 1954

The purposes of the study were: (1) to ascertain the differences in attitudes of a selected group of undergraduate college women with reference to the guidance of children, and (2) to ascertain the effect upon these attitudes of an introductory course in child development in home economics examined in relation to:

- (a) socio-economic status
- (b) intelligence
- (c) rural-urban residence
- (d) size of family
- (e) ordinal position
- (f) academic achievement
- (g) perception of childhood happiness

The study population consisted of 156 white, female, single home economics majors at Oklahoma A & M College 17-24 years of age. There were 76 subjects in the experimental group and 80 in the control group. There were no significant differences between the experimental and control groups with respect to socio-economic status, year in college, intelligence, and academic achievement.

The subjects were tested at the beginning and at the end of a semester. The University of Southern California Parent Attitude Survey and the Child Guidance Survey were utilized to obtain measures of attitudes concerning the guidance of children.

The experimental "treatment" consisted of an introductory three-hour course in child development and guidance. Laboratory observation in one of the nursery school-kindergarten programs supplemented classroom work.

Although significant changes in attitudes concerning

the guidance of children were noted in both experimental and control groups, the experimental subjects made significantly greater gains as reflected by responses on the Child Guidance Survey. The responses on the USC Parent Attitude Survey did not reflect a significantly greater gain for the experimental subjects.

The differences between means of the upper-middle and lower-middle class students were not significant. A comparison of the changes in scores between initial and final tests of experimental and control groups indicates significant gains at both levels in the control group as evidenced by scores obtained on the USC Parent Attitude Survey, but not in the experimental group. On the Child Guidance Survey both socio-economic levels in the experimental group evidenced significant gains and the students who were members of the upper-middle class in the control group evidenced a significant gain.

With respect to intelligence, students at the 50th percentile or above on the American Council on Education Psychological Examination obtained a significantly better mean score on the USC Parent Attitude Survey than did students below the 50th percentile. Responses on the Child Guidance Survey did not reflect a comparable difference, however. In general, the data indicate significant gains in both experimental and control groups irrespective of intelligence.

On the whole, the data obtained from the 156 students at the initial testing do not reflect significant differences between attitudes of students (1) from rural and urban areas, (2) from small and large families, (3) of differing ordinal positions, and (4) of differing academic achievements. When the subjects were divided in experimental and control groups significant gains were made in both groups during the semester irrespective of rural-urban residence, size of family, ordinal position, and academic achievement.

Responses of the subjects on the USC Parent Attitude Survey obtained at the beginning of the semester indicate that those students who rated the happiness of their childhood to have been "average" held attitudes which were more favorable toward the guidance of children than did those students who rated their childhood to have been "happy" or "very happy." Responses to the Child Guidance Survey, however, did not reflect such differences. In terms of gain during the semester, there is little consistency between the findings of the two instruments, with the exception of those students who rated their childhood to have been "very happy." The gains made by these students in both the experimental and control groups were statistically significant. Low percentages of agreement between ratings of childhood happiness obtained at the beginning and at the end of the semester indicate the limited usefulness of these ratings.

104 pages. \$1.30. MicA54-3056

JOURNALISM

LIANG CHI-CHAO AND HIS TIMES

(Publication No. 7589)

James Cheng-yee Shen, Ph. D.
University of Missouri, 1954

This dissertation deals with Liang Chi-chao (1873-1929), the representative figure of the grand transition in modern Chinese history from monarchy to republicanism, a man of encyclopedic knowledge, and the apostle of commonsense and common knowledge for the common people. In him the old and the new, the East and the West, clashed, blended, and effected a happy combination. To get an insight into modern China, there can be no better approach than through his works.

Liang's influence, which continued after his death till the 1930's, was exerted principally through the press. It is not too much to say that the press made him. Nor is it an exaggeration to say that he made the press, for Liang was the first Chinese who fully tapped its potentialities as a mouthpiece of public opinion and an instrument for political reforms and social crusades.

As a pressman, his influence may be said to be threefold - political, cultural, and purely journalistic. Politically, it was felt through his virile editorials and essays. Having patriotism as the motif, they fall into four stages. First, from 1896 to 1898, he stressed the necessity of general reform. Second, after the Coup d'Etat of 1898 to 1902, he concentrated his fire on the Empress Dowager and the reactionaries, holding it to be essential to protect the Emperor Kuang Hsu in order to effect reforms. Third, as the prospect dimmed for a comeback of the Emperor, Liang started to agitate for a constitution and a parliament. Fourth, the Manchus having been overthrown, Liang wholeheartedly upheld the Republic, twice leading the nation against attempts to revive monarchy.

Culturally, he was especially noted for his historical studies. He dismissed traditional historiography as pernicious, too much concerned with names and isolated events, a mere compilation of dry bones and

tomb tablets, and a source of weakness for his people. He maintained that primary attention should be paid to causes and effects, under- and cross-currents of the times, instead of surface phenomena.

He was the first Chinese to attempt a systematic evaluation of Chinese culture. Among the works he wrote on this subject may be mentioned An Outline of Cultural Development in the Ching Dynasty, and History of Chinese Political Thought (trans. by L. T. Chen; London, 1930). They are still standard works in this particular field.

Journalistically, Liang must be remembered for the creation of a newspaper style. He took the wrappings off the stiff, pontifical classical Chinese language, and turned it loose. He let in light where formerly opacity and obscurantism abounded. Under his hand, the language became easy, facile, and lucid. He devised a highly compartmented way of writing. Though later writers tended to overdo it, it appealed to his contemporaries for its clarity and novelty.

His editorials, glowing with a sense of mission, are highly moral and authoritative in tone. He may be described as the Chinese Thunderer of his time, his journals the Chinese Moral Organs. His central idea was that domestically democracy should be realized, that internationally universalism should be the ultimate goal, and that patriotism and nationalism were merely steps to the One World idea of Tatung. All his journals are bedewed with this idea of universalism. His Hsinmin Tsungpao comes closest to what he fondly cherished and constantly dreamed of as a world paper.

Liang's life was a continuous fight against bad government. The Press was his weapon in the fight. For his reformist ideas and inflammatory writings he had to lead a fugitive life abroad, mostly in Japan, for over ten years, a \$140,000 price on his head. He was in the United States for about nine months in 1903.

He edited altogether one daily and eight periodicals, and served as the conscience of Chinese newspaperdom and of the whole nation. He harbingered, if not fathered, the Chinese Renaissance of 1917.

392 pages. \$4.90. M1cA54-3057

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE PLAYS OF THE ROMANTIC POETS: THEIR PLACE IN DRAMATIC HISTORY

(Publication No. 10,023)

George Eldridge Bair, Ph. D.
University of Pennsylvania, 1951

All of the major Romantic poets – Southey, Coleridge, Wordsworth, Byron, Keats, Shelley, and Scott – showed a decided interest in the drama, and each attempted to write for the stage. Heretofore, these attempts have been studied in a kind of dramatic vacuum, or as related only to the greater dramas of the Elizabethan period. To understand fully the plays of the early nineteenth century poets, however, it is necessary to examine them in the light of the theater for which they were written and as co-existing with plays which were successful on that stage.

The large theaters built during the period from 1800 to 1815 were themselves a deterrent to serious play production and were attended by an audience which is difficult to assess. Contemporary accounts tell of riotous conduct, inattention and the like. To attempt to appeal to a wider variety of tastes than had before been present in English dramatic history, playwrights, managers and actors combined their efforts in spectacles, farcical pantomime, and pathetic plays of all kinds.

There were two dominant aesthetic impulses which influenced the serious dramas of the period. Most spectacular of these was the Gothic which exploited on the stage motifs found in the novels of Walpole and Radcliffe. These plays, best exemplified in the works of M. G. Lewis, are characterized by startling theatrical effects of all kinds, by a villain who pursues a frightened, virtuous heroine, and by an ineffectual hero. The object of the play was to elicit palpitations of fear in the hearts of the audience.

Other serious plays are almost exclusively designed to move that audience to tears on behalf of a pitiful protagonist. The villain of the Gothic in becoming a pathetic, remorseful character also becomes a hero. The heroine, instead of being simply a frightened young maiden, becomes a highly pitiful figure whose dilemma is always solved before she becomes tragic. Indeed, tragedy all but disappears in plays written during the period.

To a man, the Romantic poets wrote plays compounded of these two impulses, the Gothic and the pathetic. Their characters, like those of their more dramatically successful contemporaries, become mouthpieces for moral teachings and abstractions of virtue or vice. Their villains, heroes, and heroines also become merely pitiful. Despite the high quality

of the poetry of some of the plays, these poets add nothing significant to the drama produced during the period, not realizing that no amount of resounding moral terms nor number of shibboleths is sufficient to produce a lasting drama. Their plays are neither Elizabethan nor unique in their own time, but are closely related in subject matter, scenic effects, characterization and inspiration to other plays written between 1790 and 1832.

211 pages. \$2.64. MicA54-3058

THE THEORY AND PRACTICE OF POETIC ELISION FROM CHAUCER TO MILTON WITH SPECIAL EMPHASIS ON MILTON

(Publication No. 9708)

Robert Owen Evans, Ph. D.
University of Florida, 1954

This dissertation attempts primarily to demonstrate that elision was a poetic device, or a series of related metrical devices, that poets constantly used, from ME times until elision attained a stage of high refinement in the work of Milton, primarily for variation in syllabic verse. When English verse ceased to be accentual, i. e. when the ancient alliterative conventions were abandoned, it was replaced by new forms in which the line contained a prescribed number of syllables. In practice, however, the regular succession of lines of exactly the same number of syllables grows monotonous. Poets, almost since the inception of syllabic verse, have managed to overcome this disadvantage partly by employing the devices of elision. These were usually so commonplace that poets neglected to explain them, though from the time of Chaucer poets have supplied clues to their metrical schemes in order to prevent the reader from "mismetering" their works.

With Chaucer it is difficult to discover exactly what metrical devices he employed. This difficulty stems largely from the state of the existing MSS and editions and from the fact that he treated the final neutral vowel, *-e*, as a metrical device. But it is easy to discover that Chaucer did employ elision, that he was versatile in its use, and that he used it quite consciously. It is another matter to prove exactly how regular his lines may have been intended to be, but the evidence suggests that he strove for more regularity than is now assumed.

Chaucer also marks the culmination of metrical technique in the ME period, and he stands almost at the beginning of a firm tradition that governed, among other things, the amount and kind of elision permissible in the English decasyllable, the line that

was eventually to become the single most important English verse form. This tradition, though it was altered somewhat, continues unbroken through the 15th century in poets like Hoccleve, Lydgate, and Henryson. But at the end of the century Skelton, who also utilized the existing tradition, revolted against all of the conventional forms of verse. In the 16th century new life was brought to the tradition through the verse of Wyatt and Surrey. When the decasyllable in its blank verse guise was taken over for dramatic verse, metrical elision was also adopted. Kyd, however, did not use poetic elision as extensively as Marlowe. In Shakespeare one may trace all sorts of adaptations of these devices; however, this dissertation is content to prove that Shakespeare knew about and employed, when he so wished, poetic elisions, particularly in his blank verse tragedies. After Shakespeare both Jonson and Donne made extensive and often brilliant use of these devices.

The tradition reaches a culmination in the verse of John Milton, particularly in *Paradise Lost*. Here it is possible to prove again that the devices of poetic elision were used quite consciously, often for purposes far subtler than other poets had dreamed of, and it is also possible to trace his development of these metrical techniques through his work, showing where they occur most extensively and how Milton gradually altered them both with experience and to suit the needs of specific poems. The history is made more fascinating by the realization that critics, while they do not deny the existence of poetic elision in Chaucer or Milton, have failed to realize that elision was governed by a well-known and much practiced tradition, which in the 18th century somehow was largely forgotten. 467 pages. \$5.84. MicA54-3060

STYLE AND MEANING IN THE ORIGINAL WORKS OF SIR THOMAS URQUHART

(Publication No. 9546)

Kelsie Brown Harder, Ph. D.
University of Florida, 1954

Sir Thomas Urquhart, 1611-1660, is well known as the first translator of the first three books of Rabelais. A study of Urquhart's original works, however, has never been made, other than superficially and in connection with the translation. The analysis presented here suggests that the translator of Rabelais deserves to be considered in the light of his own development and achievement, rather than to be recognized only as a reflector of the French author's brilliance. Urquhart did not approach the task of the translation with a mind devoid of convictions and a style lacking distinctive characteristics. There is evidence in the pre-Rabelaisian original works that Sir Thomas had independently formed ideas and developed stylistic devices which, to the good fortune of

his subsequent literary reputation, coincided with what he found in Rabelais. The original works show that Urquhart did not have a vivid imagination. He did possess a mechanical imagination, but not of the type that is akin to the creative faculty. The belief that he had a vivid imagination, an idea that is often found in prefaces to editions of the translation, has been influenced by his use of a prolix vocabulary in the original works. His concern for words appears to hinder rather than promote creativity.

205 pages. \$2.56. MicA54-3061

AN EXAMINATION INTO THE SHARES OF FLETCHER AND HIS COLLABORATORS IN THE BEAUMONT AND FLETCHER CANON: AN ESSAY IN THE USE OF LINGUISTIC CRITERIA AS A SOURCE OF AUTHORIAL EVIDENCE

(Publication No. 9648)

Cyrus Henry Hoy, Ph. D.
University of Virginia, 1954

The dissertation is a study in the use of linguistic evidence as a test of authorship, specifically as the question of authorship relates to the respective shares of Beaumont, Fletcher, Massinger, Field, Ford, William Rowley, and Shirley in the plays of the Beaumont and Fletcher canon. The method has been to establish a dramatist's linguistic practices on the basis of unaided work - wherever this has been available - and then to determine which of these practices can serve to distinguish his share in a play of joint or uncertain authorship.

For the purposes of authorial evidence, the most significant of such practices is Fletcher's use of the pronominal form *ye*. The occurrence of *ye* in his unaided plays greatly exceeds its occurrence in the work of any of his known collaborators. Fletcher's unaided plays exhibit as well a regular use of such contractions as *'em* (for *them*), *i'th* (for *in the*), *o'th* (for *on/of the*), *h'as* (for *he has*), and *'s* (for *his*). While there is nothing to distinguish Fletcher's use of any of these forms from their occurrence in the work of such dramatists as Beaumont and Field, his preference for them contrasts sharply with the practice of Massinger, in whose unaided plays at the period of his collaboration with Fletcher they seldom occur. Fletcher rarely employs third person singular verb forms in *'th*, and this serves as a further point of contrast with the practice of his collaborators, who employ such forms as *hath* and *doth* with some regularity.

Taken together, such linguistic practices as these comprise a pattern of language preferences which can be traced in a play of divided authorship, and which thus serve to separate the respective shares of the collaborating dramatists. On the basis of linguistic evidence, the work of Fletcher is found to be present in forty-eight of the canon's fifty-seven plays. Of these, fifteen are plays of his sole authorship.

Thirteen plays, including his *Masque*, are wholly or in part the work of Beaumont. Massinger is present as a collaborator in nineteen plays, Field is the partial author of four, the work of Ford is present in two, and of Rowley in one. Linguistic evidence is presented which indicates with some precision the nature and the extent of the revisions which Shirley is known to have made in Fletcher's comedy of *The Night Walker*.

The numerical rate of occurrence for all linguistic forms which have been found to be of significance as authorial evidence is given by act and scene for each of the fifty-seven plays that have been examined. When single scenes contain the work of more than one dramatist a further breakdown has been given for each of the component shares. The numerical instance of all language forms that have been included is based in every case on the substantive quarto, folio, or manuscript text of the play in question.

It has been recognized throughout that linguistic evidence can only be employed as a test for authorship in those cases in which the language practices of the collaborating dramatists are sufficiently diverse as to afford a valid basis for distinguishing and identifying one or more pattern of linguistic preferences. Attention has been directed as well to the extent to which the linguistic forms that an author has employed can be altered in the transmission of a text, or as a result of revision by a non-authorial hand. Particularly in plays of joint authorship, linguistic evidence is often obscured by the tendency for some one of the collaborators to put the final form on the finished work, with the result that individual language preferences are suppressed, and the whole is given - superficially at least - the appearance of a single linguistic practice. When, however, a dramatist's work can be shown to possess truly distinct linguistic features, and when these are preserved in the extant text of a play of divided authorship, the value of linguistic criteria as a source of authorial evidence becomes apparent. In this dissertation, the extent to which Fletcher's work can be identified in collaborated plays by means of language practices is in itself a sufficient testament to the worth of linguistic evidence as a test of authorship.

533 pages. \$6.67. MicA54-3062

EARLY ISLAM AND POETRY

(Publication No. 9427)

Irfan Arif Kavar, Ph. D.
Princeton University, 1954

The conflict between Muhammad and poetry was inevitable. Islam from the very beginning was more than a religion; it was a system which sought to regulate the life and thought of its adherents in every way. Consequently it clashed with poetry, an institution which before the advent of Islam had attempted to perform part of that function. It was a struggle on an institutional level. Moreover, the conflict was inevitable on ideological grounds. The old poetry had

enshrined and extolled all the ideals which Islam set out to destroy i. e. the ethical and social code, Arabian paganism and hedonism, and above all the 'asabiyyah. There were also personal reasons which impelled Muhammad to reject poetry. His enemies had accused him of being a poet himself, and thus implied that he was not a prophet and that the Qur'an was nothing but poetry. These charges constituted a danger to the very mission of Muhammad. The poets also had ridiculed him and made him the object of their lampoons. His active opposition followed.

The hijrah to al-Madīnah brought about a change in Muhammad's attitude to poetry. There he became hopelessly involved with it. This was consonant with the predominantly temporal aspect of his personality at al-Madīnah. For the successful prosecution of the war against the Makkans poetry became indispensable; he therefore enlisted it in the service of Islam but characteristically he laid down certain rules and regulations for the composition of poetry on the part of his followers. A verse was also revealed which lifted the sanction on poetry, when composed by pious men and in the service of Islam.

In spite of Muhammad's opposition to poetry, he was deep in the debt of that art. Poetry was the school in which Muhammad's literary genius was trained. Many of its phrases, literary conceits and figures found their way into the language of the Qur'an. Furthermore, the poets had created a taste for literature among the Arabians and thus indirectly contributed to the triumph of Islam which to some extent was the triumph of a book.

In spite of the temporary eclipse which poetry experienced owing to Muhammad's opposition, it was indebted to him in many ways. Qur'anic ideas and phrases found their way into poetry and thus infused fresh blood into its being and relieved it of the spiritual barrenness, which was a marked characteristic of pre-Islamic poetry. Through Islam this poetry became universal in two important senses. It became the model of almost all subsequent Arabic poetry written in the length and breadth of the Empire by men of the most varied ethnic groups, but expressed through Arabic, the universal language of Islam. It also became neither in a remote nor in a fanciful sense the basis of the poetry of the various Muslim people who composed poetry in their vernaculars, notably the Persians, and through the Persians, the Turks. The inseparable involvement of the Qur'an with poetry was recognized early in the Muslim era. Their study formed the foundation of the Humanists' program. The impressive edifice of medieval Muslim civilization is rested on the twin pillars of the Qur'an and poetry, the two distinctively Arabian facets of that civilization.

The orthodox caliphs, especially 'Umar, continued the Muslim anti-poetic tradition, and thus contributed, among other factors, to the eclipse which Arabic poetry experienced in this period. The poetry of the Mukhadramun reflects the difficulties, technical and other which the poets were laboring under, as a result of the impact of Islam on the art of poetry.

306 pages. \$3.83. MicA54-3063

MONTAIGNE'S SOCRATES

(Publication No. 10,148)

Frederick Dale Kellermann, Ph. D.
Indiana University, 1954

This study traces the development of Montaigne's interpretation of Socrates in order to ascertain the importance of Socrates for an understanding of the *Essais*.

Montaigne came to know Socrates intimately just before the 1588 edition; there are fifteen allusions to Socrates in 1580, twenty-eight in 1588, and seventy-two in 1592. The Socratic portrayal is drawn not only from Plato and Xenophon, but also richly from Plutarch, Diogenes Laertius, Cicero, and Seneca. Montaigne's description of Socrates is unplatonic; he distinguishes between Socrates and the Platonic Socrates of the Dialogues. Many Platonic features of Socrates are rejected. Montaigne follows in outline Xenophon's portrayal of Socrates.

The sceptical element in Socrates is emphasized; there are twenty-one Socratic allusions in the "Apologie." The moral earnestness of Socrates did not appear as important to Montaigne as his confessions of humility and ignorance. The true measure of Montaigne's scepticism is found more in Socrates' "wise" ignorance than in the Pyrrhonists. Montaigne intensifies the relation between Socratic self-knowledge and self-abasement.

Socrates is the educator par excellence. Montaigne's chapter on education is inspired by Socrates and his maieutic art. The Socratic method is interpreted as a pedagogical device. Socrates' life is a model of education. Montaigne dwells on Socrates' death. The philosopher's bearing in death is Montaigne's highest ideal and the solution to his own problem of how to meet death.

Socrates is not interpreted as moralist, but rather as moral man; it is Socrates' life and the events which compose it which account for Montaigne's enthusiasm. The two qualities which Montaigne admires in Socrates are natural simplicity and rich versatility. The essayist finds an artless boldness and naïveté in all his actions.

The underlying principles of the *Essais* are merely the two rules by which Socrates directed his life: "Selon qu'on peut," and "Mener l'humaine vie conformément à sa naturelle condition"; they summarize for Montaigne Socrates' greatest wisdom. With Socrates as guide, Montaigne's moral thought is brought into proper perspective. Socrates' self-sufficiency and self-discipline are reflected in Montaigne's life. The essay "Du repentir" is best understood with relation to Socrates. Socrates' "natural" living is exemplified by "De la vanité." The exaltation of the private life in "De mesnager sa volonté" has a Socratic flavor. The development of Socrates in "De la physionomie" is merely for the purpose of illustrating Montaigne's own mode of life described in the greater part of the essay. The account of human pleasures in "De l'expérience" is sanctioned by an appeal to Socrates, the preceptor of philosophy and of all men.

Socrates forms the crown and apex of the *Essais*. He is for Montaigne a "sainte image de l'humaine forme," the highest ideal of a full and pure life which owed itself to the world as an example. Socrates' natural simplicity and rich versatility appeared to Montaigne as a delicate and hidden beauty which he compared to a secret light. The radiance of a similar light can be found in Montaigne's own life and work.

252 pages. \$3.15. MicA54-3064

JANE AUSTEN'S NOVELS: A STUDY IN NARRATIVE METHOD

(Publication No. 10,092)

Helen Morse Sanders, Ph. D.
Syracuse University, 1954

Advisor: Mary H. Marshall

This dissertation, an analysis of the six major novels of Jane Austen, excluding juvenilia and fragments, studies their structure primarily in terms of her management of the point of view, with the object of illuminating the subtle development of Austen's art. Her maturing skill especially manifested itself in establishment of a relationship between herself as author and her principal figure – always the heroine – as central intelligence, a relationship which worked to remove the presence of the "omniscient" author from the story altogether.

Essentially what develops from such an analysis of Austen's technique is a recognition that as her art matured, "point of view" came to include more and more of the elements of her story. In the early novels, with reference to the heroine it sometimes means little more than physical "position." Thus in *Northanger Abbey* the author is almost exclusively "with" Catherine; and the vision which affords moral illumination is provided by the omniscient author either in her own satiric voice or in the voice of her dramatized embodiment, Henry Tilney.

In *Sense and Sensibility*, Austen makes her first effort to endow her heroine with her own moral vision; but she is led by lack of full technical command over her material into a disconcerting multiplicity of views. We come gradually to share Elinor's position and, for long periods, her consciousness; but Austen as omniscient author keeps intruding in her own voice with supplementary, sometimes superfluous, moral judgments which enlarge or merely corroborate Elinor's views. Austen's view is often ironic, Elinor's never.

In *Pride and Prejudice*, Austen moves to eliminate the interjection of the author's separate point of view. Her heroine's moral vision is fundamentally sound; and Austen relies upon this vision in permitting Elizabeth to understand and comment upon her own errors of judgment. There is great technical advance in conveying moral vision dramatically rather than through overt comment.

In *Mansfield Park*, Austen chooses a heroine

whose limited moral vision makes the view of the omniscient author necessary; but the author severely restrains herself as a personality and does not commit herself to Fanny's moral position. With this novel there is another shift of meaning of "point of view": we frequently see events as passing through Fanny's consciousness, but the emphasis is upon Fanny's subjective reactions rather than upon the events themselves. Fanny's experiences result in growing emotional awareness; and the reader shares more deeply the inner life of the heroine during this process.

With *Emma*, the reader's "point of view" is almost entirely Emma's. Austen's technical brilliance is displayed in the way in which, keeping to this point of view, she nevertheless manages to expose the absurdities of Emma's interpretations. This exposure is accomplished through an almost purely dramatic presentation which enlists the reader's wits to construct another view for himself from the same materials (including views furnished by other characters) which are available to Emma.

With *Persuasion* the vision through which atmosphere, action, and characters all come to the reader is less Anne's point of view in the sense of "angle" of vision than the subtle but definite coloration which is Anne's whole view of life and which pervades every element of the novel.

What Jane Austen seems to have worked toward as her art matured is a structure and method in which her moral vision is an integral part of her fable as dramatized rather than an extraneous element proffered in the voice of the omniscient author. Such integration is most successfully achieved in the novels in which the heroine is sufficiently perceptive and aware to act as Austen's center of vision.

452 pages. \$5.65. MicA54-3065

**THE AMERICAN MUSEUM, A STUDY OF
PREVAILING IDEAS IN LATE
EIGHTEENTH-CENTURY AMERICA**

(Publication No. 10,016)

Howard Eugene Sylvester, Ph. D.
University of Washington, 1954

The *American Museum*, published at Philadelphia from 1787 to 1792 under the editorship of Mathew Carey, is the most representative periodical of the first years of American independence. Under the leadership of its editor, the *American Museum* reflected fully and faithfully the internal situation of the new country during the years when Americans were struggling to define their independence in social and intellectual as well as political terms.

The *American Museum* provided an outlet for both sides of the controversy over unification. It also served, at a time when no scientific or technical periodical existed in America, as a means of preserving and disseminating the theories and discoveries of American scientists; and by printing exchanges of opinion on scientific and philosophical subjects, the *American Museum* performed a valuable service in the improvement of knowledge.

An awakened social conscience, which found expression in humanitarian causes, was a particular distinction of the eighteenth century. In America, in the atmosphere of optimism which accompanied the establishment of a new social order under enlightened political principles, the ancient dream of utopian society seemed close to realization. But first, the problems of crime, disease, poverty, slavery, intemperance, and inhumanity to animal life had to be solved. The means by which these difficulties might be met and ended were matters of public discussion, and the *American Museum* served as an important medium for the exchange of ideas regarding humanitarian reforms.

Humanitarianism was especially conducive to literary activity. Contributions to the *Museum* dealing with various phases of the struggle for the betterment of mankind often took literary form. The problem of slavery in a society dedicated to the freedom of mankind produced literary treatments of themes of the noble savage. The American Indian, too, was an object of compassion, but there pressing practical considerations collided with humanitarian benevolence. Sympathetic stories and poems, depicting the pastoral innocence of savage life, were opposed by factual frontier accounts of the depredations of the Indians and by the frontier point of view of the Indian as no better than a beast.

In respect to animal life, however, it was conceded that humane treatment of dumb brutes was a certain mark of advancement toward the lodging of superior virtues in the human breast. Pleas for gentle kindness toward beasts, birds, and the meanest of God's creatures were the subjects of odes and essays, and compose a significant part of the humanitarian materials published in the *American Museum*.

The purely literary contents of the *American Museum* provide an excellent view of the condition of American literature toward the close of the eighteenth century. The poetic materials included in the *Museum* constitute the best anthology of American poetry before 1793. The slight body of criticism published in the *Museum* emphasizes the conservatism which characterized the literary theorizing of the time. Habits of mind in respect to the function and practice of literature, absorbed through long familiarity with examples and theories of British writers, could not be thrown off in a moment. But new influences were beginning to make themselves felt. Pre-romanticism was gathering force in America, and the exploration of new themes and experiments with verse forms and new modes of expression marked the work of American writers. The beauties and advantages of the predominately rural and agricultural character of the American world were given enthusiastic expression by American writers. The classical pastoral was adapted to the conditions of American life, and was extended to include the characters and situations of the American frontier.

An American literature had not arrived. It, like other representative expressions of the quality and dimension of American thought and character, awaited the definition of time and experience. The *American Museum*, by recording the prevailing patterns of early national life, served its period well.

378 pages. \$4.73. MicA54-3066

LANGUAGE AND LITERATURE,
MODERNBRITISH POETRY OF SOCIAL PROTEST IN
THE 1930'S: THE PROBLEM OF BELIEF
IN POETRY OF W. H. AUDEN, C. DAY LEWIS,
"HUGH MacDIARMID," LOUIS MacNEICE,
AND STEPHEN SPENDER

(Publication No. 8533)

Edith Trelease Aney, Ph. D.
University of Pennsylvania, 1954

Supervisor: Dr. Mark Longaker

Revolting against parental authority and searching for belief in a world of unbelief, the poets of social protest desired both to relieve suffering and to change those conditions which jeopardized their position as poets and which threatened to make Britain too weak to resist Fascist irrationalism.

The attack was directed against the chief failures of public life: the degradation of business ethics; self-interest and apathy in Parliament; dishonesty of government and Labour in the General Strike of 1926; inability of the present system to prevent depressed conditions or to abate them; Labour's failure to inspire confidence and to offer constructive reforms; the disregard of radio, newspaper, and film for truth and their effect of imposing upon the public conformity and mediocrity of taste and opinion; and finally the failure of the middle class to respect intellectual, artistic, or emotional achievements. Since the only political party whose attack coincided with theirs was the Communist Party, many intellectuals became emotionally committed before they understood how strict the demands of orthodoxy were to be.

In Scotland, "Hugh MacDiarmid," a Scottish Nationalist of the working class, ceased writing lyric poetry of a superior quality in order to develop a propagandist form. As his attachment to the Communist cause became more rigid and unrealistic, he became completely propagandist in purpose, and the "poetry" evaporated.

In England, Louis MacNeice was a bystander, the typical enlightened English observer, who desired peace and prosperity but who attempted nothing himself toward achieving them. Representing the English attitude of appeasement before the war, his was a poetry of objects and things, lacking belief and consequently depth.

When Cecil Day Lewis became an active Party worker, he ceased writing original, experimental verse and began writing propaganda. Not until he had repudiated Communist orthodoxy in 1938 was his independence and originality restored him.

Stephen Spender's visionary poems express that perfect confidence in the future proletarian state which inspired so many. His faith shaken later by the Moscow trials, by expedience and duplicity in the Party at home and in the Spanish Civil War, and by the Party's resistance to criticism, Spender's disillusionment manifested itself in his poetry by a disruption of form and content.

Auden's strong belief in Truth and Love as abstract ideals, as well as a single-minded dedication to poetry, prevented him from ever becoming deeply involved politically or emotionally. Revealing his impatience with British narrowness and self-satisfaction, Auden's poetry was psychosocial in nature and always urged self-knowledge and love as the fundamental requirements for peace and progress. Even the ideological poems take heed of the ambiguity and complexity of life.

Oversimplification of issues, excessive negativity, and failure to hold in equilibrium the poetic function, the experience, and the abstract principle disrupted the poetry of social protest. It failed when it lacked constructive beliefs (MacNeice's poetry), had little contact with life (Day Lewis'), was too general (MacDiarmid's), or lacked confidence (Spender's). Where the belief represents perfect faith (Spender's visionary poems) or where it refused to compromise with truth, either by commission or omission, and did not subordinate human life to belief (Auden's poems), it was often highly moving poetry of an enduring quality.

All this poetry illuminates the central conflict of our century - the struggle of the human spirit to preserve its freedom and integrity against the encroachments of Fascist irrationalism and Communist theories of expedience. 414 pages. \$5.18. MicA54-3067

THE NOVELS OF VIRGINIA WOOLF

(Publication No. 9731)

Frank Baldanza, Jr., Ph. D.
Cornell University, 1954

Virginia Woolf's critical and biographical essays and her diary reveal that her sensibility was shaped by her wide reading and by the interests of her friends in the Bloomsbury group. She was drawn to Chaucer, Defoe, Jane Austen, Conrad, and Hardy, the "great plain writers," for their straightforward honesty and their unobtrusive treatment of moral problems. She was attracted to Sir Thomas Browne, Donne, and Montaigne by their courageous exploration of the self. She supplemented what she learned from these "keepers of the keys of solitude" by reading in the Russians who investigated both the "dark places of psychology" and the relations of the self to exterior reality. From G. E. Moore's *Principia Ethica* she drew her system of values, which put the major emphasis on good states of mind, and she developed this value system within the tradition of Pater and Wilde's aestheticism as it was passed on to her by the theories of Roger Fry and Clive Bell.

The aesthetic theory which she formulated put strong emphasis on the autonomous, self-perpetuating nature of a work of art, which should have as its sole end the communication of emotion; she was adamant in her opposition to priestly didacticism. In her own mind, her works could be divided into two groups, novels of fact (*Night and Day* and *The Years*) and novels of vision (*To the Lighthouse* and *The Waves*),

although her ultimate aim was to blend the two, as she did in *Between the Acts*. In practice, she always dealt with "fact," by which she probably meant the exterior world, as it is illuminated and transformed by her mystic vision of reality. In delineating states of mind in the novels, she typically concentrated, in her feminine characters, on the "party consciousness." This is a mystic state of mind in which the surrounding sounds, objects, and persons become amalgamated into a unity that is a vision of ultimate reality. The form of her most successful novels is a pattern of such moments of vision as they occur on one typical day during which the characters anticipate and eventually enjoy some festival or social communion (the party in *Mrs. Dalloway*, the dinner and the trip in *To the Lighthouse*, and the pageant in *Between the Acts*) which is usually accompanied by the attainment of the final vision.

Her psychology was based on the metaphor that each individual is composed of a multiplicity of selves which blend under the control of a master self during moments of vision; she also believed that the mind is composed of male and female traits, and that in the moment of revelation the mind becomes androgynous. Since she was abnormally sensitive to time, she also maintained that in the moment of vision the sense of the past and the complex apprehension of the present become unified. Thus the moment of vision suspends in the consciousness the multiple selves, the various sexual traits, and the varied consciousnesses of time in the individual. The work of the greatest artists, she says, is pervaded by a sense that the writer's self is everywhere in control but nowhere in evidence.

Mrs. Woolf has contributed to the tradition an example of a looseness and freedom of form, of a use of words as ends in themselves, which had heretofore been considered the prerogative of poetry alone, and of a pervasive unity based largely on the active cultivation of the subconscious during composition. She has chosen to represent the inner life almost exclusively, and has drawn into the novel states of mystic consciousness which Whitman had brought to poetry.

377 pages. \$4.71. MicA54-3068

THE LATE METHOD OF HENRY JAMES

(Publication No. 10,064)

Douglas Theodore Bockes, Ph. D.
Syracuse University, 1954

Adviser: E. Dady

After the disastrous failure of his play *Guy Domville*, in 1895, Henry James gave up the theater. This momentous defeat had three important effects upon his career. First, he found a powerfully renewed urge to return to writing fiction, his true *metier*. Also, the disillusionment following his failure to establish himself through the drama as a popular writer drove him into himself, producing at first the tales of isolated writers and haunted introverts and

then the great psychological novels of "the major phase." Finally, having absorbed the technique of the drama, he completed the evolution of his method of writing fiction.

Through the prefaces in the New York Edition of his selected works, we can follow the development of his art, keeping in mind, though, that the author in his later years occasionally sees his development as proceeding in a straight line. But only the successful achievements, as he saw them, were collected here.

A survey of key novels and tales from this selection shows that the chief technical elements of "the major phase" – the scenic method and the fine consciousness – can be found in his earlier work, though they are seldom employed in the tight structural patterns of the later work.

The scenic method becomes fully established only after James's experience as a playwright. He builds his novel or tale about certain key scenes with the plot proceeding by action and conversation as in a play. He also learned the art of dramatic exposition: how to present antecedent material, necessary for understanding the action, without interrupting the flow of the plot. Occasionally the scene is non-dramatic; a character may be shown in inner conflict with himself or his situation, a sort of unspoken soliloquy which James calls "picture."

But in order to make his scenes dramatically effective, James juxtaposes against them the exhibition of the fine consciousness, whether in the central character, in each character of a group, or in an observer. In these sections of a novel or tale, James is preparing for the impact to be produced by the next scene upon both the character and the reader.

Of the late works, *The Ambassadors*, which James found the most satisfactory of all his novels, best illustrates James's alternation of scene and exhibited consciousness. Here the two elements of his method regularly and rhythmically reinforce one another. In one chapter we see Strether's consciousness at work within himself; in the next we see him in action, either in dialogue with a confidant or in active conflict with an antagonist; then we see him again digesting the events of the scene as he prepares for the next action. Although Strether is extremely intelligent and sensitive, he is not super-human; he can be fooled, and during the scenes the reader is able to gauge his blindness as well as his perceptiveness.

In the cohesion achieved by uniting these two elements, James managed to banish all irrelevant and extraneous material – comic relief, sub-plots, and description for its own sake.

James's late method is an organic form, suited to his temperament and vision of life, developed over a period of forty years. He looked upon the novel as an art form and not merely as casual entertainment, and he demanded his reader's full attention. The late novels are not the work of a tired old man retreating into himself from a hostile, indifferent world; they are the work of an artist's fullest maturity climaxing a life devoted to his craft and re-dedicated to it after a not unfruitful detour.

201 pages. \$2.51. MicA54-3069

**THE NEW ORLEANS DOUBLE DEALER:
1921-MAY 1926, A CRITICAL HISTORY**

(Publication No. 9933)

Frances Jean Bowen, Ph. D.
Vanderbilt University, 1954

Three main procedures were employed in making this critical evaluation which established The Double Dealer as one of the more important little magazines that flourished during "the nineteen-twenties," a magazine whose output, eight volumes totaling forty-three issues, was published in New Orleans by Julius Weis Friend, John McClure, and Basil Thompson from January 1921, through May, 1926. They were as follows: a detailed study of the magazine contents, a series of conversations with those editors who still live in New Orleans, and correspondence with the sixty contributors who published in the periodical and who have attained sufficient eminence in the field of letters to be listed as writers in Who's Who in America, 1951.

The study presents these findings:

The "double deal" as originally conceived and executed was a facetious, Congrevean approach to society, politics, and art; an oblique, tongue-in-the-cheek attack on the weaknesses and at the same time a winnowing out and championing of the sound in both the old and new regimes. Since neither the attack nor the approval was intended to be heavy, "light stuff" was included whenever acceptable artistic contributions ran short.

Within three years the youthful editors matured to such a degree that banter at the expense of human error shifted into a tolerant and philosophical analysis of human behavior, which included their own foibles. Finally, they turned to the publishing of literary works exclusively. The excellently written and timely editorials were discontinued.

In the first two years during which the editors "expressed the truth as they saw it" and "let the chips fall where they would," they offended many of the leaders of both camps. By 1925 it was apparent that they would have to choose between compromising to meet popular taste or discontinuing the publication. "Hotspurs" to the end, they chose the latter course. With no apologies they went off the press.

Other factors are pertinent to this study. They never made expenses. Their circulation was composed largely of literary aspirants who had ideas and courage but no money. McClure, Thompson, and Friend were business men, the first two entirely dependent upon their vocations, newspaper work and insurance. Throughout the lifetime of the magazine its deficits were met by Julius Weis Friend.

But the five and one half years bore fruit beyond the editors' expectations. Of the two hundred and ninety-three contributors, nearly all of whom were unpaid, thirty-three became distinguished writers before their death, sixty of the remaining two hundred and sixty are nationally recognized authors today; and of this number forty-five expressed their indebtedness to the little magazines, stating that were it not for them, they doubtless never would have published anything.

Without exception, the fifty-five writers who answered the author's request in the summer of 1952 for a statement about the literary value of the little magazine movement in general and The Double Dealer in particular emphasized the artistic importance of the movement. Succinctly Robert Penn Warren wrote, "Certainly the little magazines were important to me. They published my poems and they published, by and large, the poems of the people who interested me most. . . ."

Of these fifty-five, twenty-five of the writers who made comparisons placed The Double Dealer among the most important little magazines. Allen Tate rated it the best edited with the possible exception of the better financed Dial.

William Faulkner, Ernest Hemingway and Thornton Wilder published their "firsts" here, Robert Penn Warren and Allen Tate their "seconds." Ezra Pound's defense of Carl Sandburg, Walter Yust's satire on the "left-wing" DaDa movement, Faulkner's statement of his artistic indebtedness to the Romantics are but a few of the provocative contributions to The Double Dealer.

448 pages. \$5.60. MicA54-3070

HAWTHORNE AND RELIGION

(Publication No. 10,140)

George William Bowman, Ph. D.
Indiana University, 1954

Hawthorne, one of the most moral of our American writers, grew up and lived in the midst of a period during which the traditional forms of religion as well as the basic theology of the past were being questioned. His church views and practices were naturally affected by this religious unrest. He was basically religious in his nature. This fact is indicated by the comments of his friends and members of his family, by the themes of his writings, by his habitual reverence, and by the frequent references in his works to the Bible and religious matters.

His notebooks show a more frequent attendance at religious services than the critics have believed. His lack of regular attendance was due to his dissatisfaction with the organized religion of his own day - a dissatisfaction felt by many other thinkers of the time, including Emerson. He felt a tie with the Puritanism of his ancestors and saw a falling-away from the simplicity and sincerity of that earlier day. His antagonism to the religious sects that sprang up was due to their fanaticism and intolerance, the hypocrisy of their clergy, the insipidness of the sermons, their seeming emphasis upon church rites or external religion, and his own feeling of the futility of their passion for reform.

Although he was suspicious of any set of religious dogma, Hawthorne's religious ideas do form a fairly consistent pattern. Man's nature is evil, earthy. Guilt and wrong are inevitable. However, man has a celestial part as well as an earthly part as indicated in the fact that he loves more readily than he hates.

The important thing is to understand mankind and to find a sympathy with him, recognizing the good and evil in our common nature. This common heritage of sin plays an important part in the development of man - and mankind. The only real cure is the power of love. The chief evil that can come from sin is the separation from the world of men. Such separation is a sin in itself and can be helped only by an awakened sympathy for others. The other, and better, part of the dual nature of man is spiritual. This is far more real and enduring than the earthy element.

Hawthorne derided the superstitions of his day, including the passion which even his wife had for spiritualism. His belief in heaven, immortality, and a superintending providence, however, was rather conventional - and an important part of his religious concept. He never doubted that there is a purpose in the universe, that Providence guides the activities of men. He believed that faith is an essential part of a happy life, the guide of man through his earthly existence.

His great theme, though, was conscience. Violation of it is violation of the innermost man. There is only one thing that can cleanse the soul from the stain of sin - sincere repentance. Morality and religion cannot be separated; however personal integrity is the essence of a religious life. The religion that finds no purpose in life is no true religion.

180 pages. \$2.25. MicA54-3071

PERSONIFICATION IN EIGHTEENTH-CENTURY POETRY

(Publication No. 10,170)

Chester Fisher Chapin, Ph. D.
Columbia University, 1954

This study examines the personified abstraction in the light of eighteenth-century attitudes toward the figure as exemplified in the writings of poets and critics from Addison to Erasmus Darwin.

Two principal types of the figure are distinguished - a type which approaches the nature of the allegorical "picture" or "vision," and a type which shows certain of the characteristics of metaphor. While there is no sharp line of division to be drawn between these two sorts of personification, the differences between them have seemed of sufficient importance to justify the organization of this essay into two parts. Part I deals with the allegorical type of personification, Part II with the metaphorical type. It is concluded that the two sorts of personification are each of them associated with a different poetic tradition. The metaphorical type is found to be especially suited to the neoclassic "poetry of statement," while the allegorical type is seen to be especially favored by those mid-century poets who derive much of their inspiration from the minor poems of Milton.

Part I traces the development of what is called the "empirical" theory of poetic imagination. Addison, in the *Spectator*, associates the personified abstraction with the "fairly way of writing"; that is,

with the depiction of non-empirical personages and scenes of being. The figure, having no prototype in empirical nature, is thought of as a highly imaginative "fiction," and is frequent in the verse of the Wartons, Collins, and other mid-century poets who rebel against what they consider to be the excessively prosaic, unimaginative character of the neoclassic "poetry of statement." The personified abstraction thus becomes an allegorical figure of fancy, much of its value being felt to lie in its appeal to that faculty of mind which delights in the contemplation of objects which are "out of nature." Part I traces this conception of poetic personification to its late-century exemplification in the verse of Erasmus Darwin, a poet who employs the figure as a "mechanical device of style" in order to achieve something of that imaginative splendor which critics found in the allegorical odes of William Collins.

Part II begins with a discussion of attitudes toward poetry held in common by Johnson and Pope, the most talented representatives of a tradition which holds that true poetry should deal significantly with the "actualities of life." In the verse of Johnson and Pope, the personified abstraction becomes a rhetorical device designed to dramatize the effect of moral or satiric "statement." It frequently attains the virtues of good metaphor, and is found to be the most valuable type of personification in use among eighteenth-century poets.

The final conclusion reached is that personifications become "real" to the eighteenth-century mind when they are felt as dramatizations of the values, affections, or qualities which relate to the activities of man in the empirical world - not when they are projected as figures from a non-empirical world of fancy. An exception is noted in the case of William Collins, but Collins, it is maintained, is able to convince himself of the essential reality of his allegorical figures as evocations in "sensible" form of those "ideas" of the supreme mind which "originally gave birth to nature." Other poets, assuming that all knowledge is ultimately empirical, are unable to believe in the essential reality of their own allegorical "fictions." The modern reader, sensing this, cannot contemplate this type of poetic personification with that degree of serious assent which he gives to the figure when it is seen to reflect the poet's serious concern with the actualities of the life around him.

224 pages. \$2.80. MicA54-3072

THE SIMILE AS A STYLISTIC DEVICE IN ELIZABETHAN NARRATIVE POETRY: AN ANALYTICAL AND COMPARATIVE STUDY

(Publication No. 9541)

Ethel B. Colbrunn, Ph. D.
University of Florida, 1954

The simile is a very prominent feature of Elizabethan narrative poetry. This study examines the similes of some representative narrative poems of the Elizabethan period to determine how those similes

are used stylistically. The similes of individual poets are analyzed and compared with those of other poets. Both the particular differences and the common characteristics peculiar to the poets of the period are considered. For background and to serve for comparison and contrast, the study includes some of the long poems of Chaucer and Alexander Barclay. The Elizabethan poems comprising the principal part of the study are: The Mirror for Magistrates, The Faerie Queene, Hero and Leander, Venus and Adonis, The Rape of Lucrece, Endimion and Phoebe, and Mortimeriados. Works of two Spenserians of the early seventeenth century, Giles and Phineas Fletcher, are included for contrast.

The rate of frequency with which similes occur in the poems, the kinds of structural patterns employed and in what proportions, the functions the similes serve, and the subject matter of the similes are important factors affecting style. There is an increasing rate of frequency from Chaucer to Shakespeare after whom there is a slight decrease in the number of similes but an increase in the complexity of the similes. The Elizabethans and their predecessors are careful to make very clear the relationship of the two things being compared. Only Chapman is sometimes confusing in this respect, and he is also the only one of the Elizabethans studied whose similes are long digressions. Typical of the others is the simile which is confined to the stanza and whose details are carefully related to the subject of comparison. The majority of the similes illustrate or amplify (in the sense of making noteworthy). At the same time they create a sensory impression, express movement, depict an emotional state, or illustrate a permanent quality. Here there is great variation among the poets. Shakespeare and Marlowe introduce movement into their poems through the similes to a notable degree. Spenser displays balance in the functions which his similes serve. The others tend to employ a static type of image most often. The poets also differ in the subject matter which appears most frequently in the similes, but a conspicuous common trait is their preference for inanimate nature and especially for images of light, which most often are of the sun and stars.

The poets who wrote The Mirror for Magistrates handle the simile with varying degrees of skill but, in general, more clumsily than the later and greater poets. Spenser uses a great variety of subject matter, including many animal similes, but he contrives to make nearly all harmonize with the mood of a medieval romance. Marlowe, Chapman, and Drayton add to the literary flavor of their poems by a preference for images from mythology and by the type of artifacts to be found in their similes. Shakespeare enlivens his poems with refreshing scenes of the real world of nature and men, which partially compensate for what is missing in the actions and settings of the stories. The luxuriance of imagery and rhetoric in Shakespeare, Marlowe, and Drayton appears moderate beside the excesses of the Fletchers. The Elizabethans know how to use the simile to help establish the mood of a poem, to illustrate, to aggrandize, to clarify the meaning, to vivify, to vary, to add to the

associational texture, and to enhance in general the artistic effect of the poetry.

315 pages. \$3.94. MicA54-3073

THOMAS MIDDLETON'S CITY COMEDIES

(Publication No. 10,172)

Daniel Boone Dodson, Ph. D.
Columbia University, 1954

The discovery by Mark Eccles of Thomas Middleton's correct birth date of 1580 has never been applied to a revision of the early canon. This discovery along with some other fragmentary evidence makes it highly unlikely that the dramatist was engaged in writing for the London theatres before 1602. As a consequence, and in view of extensive internal evidence already alluded to by previous scholars, it is now possible to assign Blurt, Master Constable to Dekker. The Phoenix, written in the middle of 1603, contains allusions to King James and a warning on the toleration of Catholics; in addition it is likely that Dekker had a hand in the planning and execution of the serious portions of this play. The Family of Love was apparently written by Dekker in 1602 and revised by Middleton after April, 1605, at which time satire on the Familists was added; the original play seems to contain evidence that Dekker was preparing another diatribe in the War of the Theatres. Dekker-Middleton collaboration was continued in I The Honest Whore; Middleton's part in II The Honest Whore is very small. The final collaboration between the two dramatists, The Roaring Girl, as R. C. Bald has suggested, falls in 1607-08. Internal evidence on the dates of the other City Comedies generally lends support to the work of R. C. Bald. There is substantial proof that in the first ten years of his work for the London theatres (c.1603-c.1613) Middleton, when he was not collaborating, concerned himself only with City Comedy. There is no need therefore to try to trace his early development from Romantic Comedy to the realistic comedy of London life. After c.1612 the influence of Fletcher produced a gradual change in the direction of tragicomedy.

In his City Comedies of sole authorship Middleton borrowed extensively from Latin New Comedy and from Jonson's Every Man in His Humour for plot. His observance of unities is not as strict as that of Jonson, Plautus, or Terence, but on the level of action and motive there is very little innovation observable in his work. On the other hand his development of certain character types inherited from Latin comedy and from Jonson is singularly indicative of his intentions as a satirist and realist. Unlike Jonson who was concerned with the exposition of the warping effect of a predominant humour, Middleton shows us human beings perfectly oriented in a world of predatory acquisition and lust. The predictability of the humour character is replaced by the pressure of economic determinism. The usurer becomes a negative hero in an aggressive and unrestricted economy, producing a depraved and bestial sexual mores. The wittol, the

gull, the prostitute, as well as the young man are forms of human reaction to the forces thus unleashed. The prostitute, particularly, is a victim rather than an innately depraved woman, and Middleton's sympathy for his socially rejected characters gives them a sort of oracular perspective on the economic processes at work in the bourgeois asceticism of Jacobean England.

Middleton's satire does not have the overt indignation of Jonson's or Massinger's. He suppresses the traditional didacticism which is so characteristic of Jonson, and yet when these plays are examined as a group an attitude does seem to emerge. Critics like L. C. Knights and T. S. Eliot, who have denied the existence of such an attitude, overlook the repetition of the same sinister symbols and the same dislocated victims in play after play.

253 pages. \$3.16. MicA54-3074

NIKOLAI LESKOV: THE INTELLECTUAL
DEVELOPMENT OF A LITERARY
NONCONFORMIST

(Publication No. 10,173)

William Benbow Edgerton, Ph. D.
Columbia University, 1954

It is generally recognized that a reappraisal of Nikolai Leskov's position in Russian literature is long overdue. Both his ideas and his artistic methods set him apart from the common run of Russian writers. While progress has been made in recent decades in the study of his style, the nature of his thought still remains almost as controversial as it was at the time of his death in 1895.

This study deals with Leskov's intellectual development from his birth in 1831 to the end of his allegedly reactionary period around 1880. Despite his deep roots in the purely Russian soil of Orël Province, his cultural formation owed much to non-Russian influences. When he began his literary career in 1860, his intellectual outlook was oriented more toward the half-Polish, half-Ukrainian city of Kiev than toward either Moscow or Petersburg. In his lifelong devotion to individual liberty, his practical, nondogmatic attitude toward political and social questions, his Anglophilism, and his essentially Protestant approach to religion, he undoubtedly owed much to his associations with his English relatives in Russia, notably his uncle by marriage, Alexander Scott. This outlook on life set him apart in the 1860's and 1870's from both the doctrinaire radicals and the doctrinaire reactionaries among his fellow Russians, and eventually aroused the hostility of both groups. Virtually ostracized from Russian literature in 1865 as a result of the radicals' attacks upon him, he gravitated toward Mikhail Katkov and the conservatives. Even at the time of his closest association with the conservatives, however, he gave evidence of his independence by writing *The Cathedral Folk* (Soboriane, 1866-72), in which he defended religious tolerance and attacked the bureaucracy and dead

formalism that he believed were stifling the real spirit of Christianity in the Russian Orthodox Church.

The turning-point in Leskov's intellectual development came in 1875. While visiting Western Europe he read many religious works forbidden in Russia, notably the writings of Protestant theologians. This gave new stimulation to his long-standing interest in native Russian nonconformists. Within the next year – and some time before Tolstoy himself – he began publishing articles and literary works that revealed the essential spirit of what was later to be called Tolstoyanism.

The concluding section of the present study analyzes Leskov's relation to Tolstoy and draws the conclusion that Tolstoy served as a sort of catalytic agent in Leskov's philosophy, crystallizing a set of convictions that had been in the process of formation since his early childhood. An examination of a strangely neglected newspaper article by Leskov on Tolstoyanism ("O rozhne," 1886) shows that, contrary to the general impression, Leskov both understood and accepted Tolstoyan nonviolence but disagreed with Tolstoy's doctrinaire application of the principle. Nevertheless, he remained to the end of his life a devoted follower of Tolstoy.

Besides drawing on all the published literary and journalistic works by Leskov and all the published correspondence and memoirs dealing with him that are known to exist outside of the Soviet area, the present study also draws upon the unpublished memoirs of Leskov's granddaughter, Natal'ia Dmitrievna Bakhareva; the unpublished memoirs of the late Professor N. M. Bubnov, who lived as a boy in Leskov's home; newly discovered letters from Leskov to I. S. Gagarin and V. A. Pashkov; and a now inaccessible collection of some 200 letters addressed to Leskov. The memoirs provide hitherto unknown information about Leskov's unhappy marriage and his ten-year liaison with Ekaterina Stepanovna Bubnova, and the letters throw further light on his religious convictions.

425 pages. \$5.31. MicA54-3075

RENAISSANCE AND MODERN THEORIES
OF IRONY: THEIR APPLICATION TO
DONNE'S SONGS AND SONNETS

(Publication No. 9750)

James Jack Gindin, Ph. D.
Cornell University, 1954

This thesis consists of a consideration of theories of irony formulated in both the English Renaissance and the twentieth century and of the application of those theories to John Donne's *Songs and Sonnets*. The aim of the thesis is to demonstrate how helpful a consideration of irony is in explaining the poems involved.

The first chapter summarizes the critical accounts of irony in the twentieth century. The theories of irony formulated by critics such as Cleanth Brooks, Allen Tate, and William Empson are discussed. Among the principal generalizations made are that

the modern critics look at irony in poetry as frequently revealing a fundamental awareness of multiplicity in the universe, or protecting the poet from over-simplification and sentimentality. Irony is also regarded as a technique, a means of developing the structure of the poem, and, as technique, can function through any element in the poem. Above all, irony is frequently made a criterion of value, for what is ironic is, in modern criticism, often called good.

The second chapter discusses irony in the critical theories of the Renaissance. Here, most of the sources are the Elizabethan rhetoric books, although critics, like Puttenham, are treated. In Renaissance criticism, irony is thought of as a "trope," a means of decorating language applied primarily to a word or phrase or sentence. Irony, mentioned seldom in Renaissance criticism, has a limited critical function. Irony can reprove, deride, insult, but it is almost always directed outside of the poet and is not thought of as revealing anything about the poet himself. Irony is almost never made an attitude toward the world. In fact, the Renaissance notion of decorum works against any far-reaching concept of irony.

The third, and major, chapter consists of a careful analysis of fourteen of Donne's *Songs and Sonnets*: *Twicknam Garden*, *Womans Constancy*, *Loves Usury*, *The Triple foole*, *Breake of day*, *The Message*, *The Canonization*, *The good-morrow*, *Lovers infiniteness*, *The Extasie*, *The undertaking*, *Negative Love*, *The Anniversarie*, and *A Nocturnall upon S. Lucies Day*. These analyses show the different kinds of irony and the different means of handling irony in Donne's poetry. They also indicate how irony can be used to explain the meaning and development of the specific poems.

The fourth chapter attempts to provide an explanation for the fact that Donne so frequently used irony. The explanation of the "climate of opinion," the seventeenth century environment where man was caught between two contradictory systems of belief, is examined and found inadequate to explain Donne's irony. Donne's background is examined and affords a partial explanation, but the principal explanation for Donne's irony in the *Songs and Sonnets* resides in the individual cast of mind and the development of poetic technique.

The final chapter shows that both the Renaissance and modern theories about irony are inadequate in explaining Donne's poetic practice. The Renaissance critical accounts limit irony too much; the modern accounts, though more satisfactory, also do not allow for all Donne's uses of irony. In addition, the modern accounts make irony an evaluative term. Irony, in order to be valuable as a critical term, must be used descriptively, must be used as a way of getting at the meaning of a poem. Modern critical accounts also convert irony into a system, applying it to poems for which some other critical term would be more meaningful. In making the critical term a system and in making it evaluative, modern critical theorists extend the use of irony to a point where it is no longer useful in explaining a particular poem.

192 pages. \$2.40. MicA54-3076

DIFFICULT CONTEMPORARY SHORT STORIES:
WILLIAM FAULKNER, KATHERINE ANNE
PORTER, DYLAN THOMAS, EUDORA WELTY
AND VIRGINIA WOOLF

(Publication No. 10,004)

Allen Wallace Graves, Ph. D.
University of Washington, 1954

This study presents a new method of analyzing difficult contemporary short stories which in their obscurity read like abstruse modern poetry. It is a method of analysis which instead of approaching the obscurities through critical terms such as Atmosphere, Character, Key Moment and Conflict, faces directly each difficulty as it appears in context in each story, and makes a direct assessment as to (1) precisely what the obscurity is, and (2) whether it is justified artistically.

One common factor in the stories under study is that they neglect the obligation of keeping the reader informed at all times as to what characters are before him and who they are; where they are; what they are doing, and why, when and how they are doing it, which is in the main the traditional obligation of fiction. The stories in this study deviate noticeably from this tradition. They are analyzed word by word and each time a story does not reasonably fulfill this narrative flow, the stoppage is noted. As a result of this analysis, some conclusions are possible regarding what techniques make these stories obscure, and what peculiar artistic effects are attained through the use of these obscure techniques. These conclusions furthermore suggest possible faulty techniques, and show in what areas and by what authors apparent unnecessary obscurity occurs.

The eighteen stories analyzed in this study are Faulkner's "Barn Burning," "Carcassonne," "Hair," "Red Leaves" and "Was;" Miss Porter's "Flowering Judas," "He" and "Pale Horse, Pale Rider;" Thomas's "The Burning Baby," "The Orchards" and "Patricia, Edith and Arnold;" Miss Welty's "Asphodel," "The Burning," "Death of a Traveling Salesman" and "The Wide Net," and Mrs. Woolf's "The Duchess and the Jeweller," "A Haunted House" and "The Shooting Party."

Thirteen of these stories are chosen for analysis because they seem particularly obscure; the remaining five - one per author - are chosen for contrast as representative "easy" stories. Some of the stories are very easy, as Miss Porter's "He," in which there are no stops at all. Some are very difficult, as Faulkner's "Was," in which there are eighty-four obscurities or Thomas's "The Orchards," in which there are ninety. Among these eighteen stories there are a total of 633 stoppages of narrative flow recorded. These obscurities are grouped into twenty different types of difficulties which contribute to this slowing of narrative flow. These types fall into five categories: limited presentation of facts, abstruse grammar and structure, difficult imagery, peculiarities of psychic process and questions of significance.

The worth of this critical method of grouping of obscurities into specific types is revealed when these

types are charted for an individual story against an average curve of occurrence for all eighteen stories. The charts of single stories reveal in what areas each story deviates most noticeably from the other difficult stories in this study, and also how each story deviates from traditionally "easy" prose.

A major part of this study consists of essays on the five authors, in which the obscurity of their prose under study is discussed in detail, and in which unusual artistic aims and possible lack of aims are suggested. It is concluded from these analyses that the modes of expression of realism and symbolism, long common in fiction, have in many of these stories been muted into a lyric expression which appears to be the greatest single mutation of form which the short story has lately undergone.

187 pages. \$2.34. MicA54-3077

**SÉBASTIEN BREMOND: HIS LIFE
AND HIS WORKS**

(Publication No. 10,144)

Edwin Paul Grobe, Ph. D.
Indiana University, 1954

Original manuscripts establish that Sébastien Bremond is the correct name of the seventeenth-century French novelist commonly known as Gabriel de Brémond or Saint-Brémond - errors of identification resulting from confusion with an authentic and contemporary Gabriel Brémond and from misinterpretation of the author's usual signature, S. Bremond. The same sources supply biographical details not previously known. Born in Provence (1646?), Bremond traveled in Spain (1667), Tunis (1668), central Europe (1669-1670), Holland (1671), London (1672-1674), where he married Marie-Angélique de Loménie and frequented the Restoration Court, Flanders (1674-1676), and England again (1676-1678). He next represented various European governments in The Hague and secretly reported the activities of William of Orange to Paris (1678-1692). Arrested as a spy and imprisoned at The Hague (1693-1698), he served as French consul at Jerusalem (1699-1701) and Messina until his death (1702-1705?).

Previously classified as anonymous, *L'Amoureux Africain* (1671) and *Homaïs, reine de Tunis* (1671?) are identified as Bremond's novels by their presentation of political intrigues in which he participated in Tunis and of government figures whom he knew there. He also wrote *Le Cercle, ou conversations galantes* (1673), *Hattigé, ou les amours du roy de Tamaran* (1676), *Le Galant Escroc, ou le faux comte de Brion* (1676), *La Princesse de Monferrat* (1676), *L'Heureux Esclave* (1677), *Le Triomphe de l'amour sur le destin* (1677), *Le Double Cocu* (1678), *Le Pelerin* (1678?), and *Memoires galans* (1680). His *Apologie, ou les veritables memoires de Marie Mancini* (1678) is a revised edition of Marie Mancini's authentic memoirs, *La Verité dans son jour* (1677). *Guzmán de Alfarache* (1695) is a free translation of Mateo Alemán's Spanish original (1599).

Representing many minor French novels of 1660-1680 which, in reaction against the long heroic romance, utilized improved or new realistic techniques, Bremond's works, composed in the shorter *nouvelle* form, renounce the doctrine of the "commencement par le milieu," frown upon the marvelous, choose subjects from contemporary history and themes from current social problems, and portray heroes motivated, not by matchless courage and steadfast virtue, but by meaner and more typically human passions. A more successful exponent of these new techniques than many, Bremond was able, as well, to write authoritatively of foreign locations, customs, events, costumes, and personages observed in his travels, thus creating a documentary realism that is the chief distinction of his works.

Bremond's novels enjoyed a certain popularity in France, going through some sixty editions between 1670 and 1750. Their greatest success, however, was in England, where they were read in French, went through some thirty-five editions in English translation between 1675 and 1730, and provided plots for writers of Restoration comedy, including Dryden, Aphra Behn, Thomas D'Urfey, and Mary Pix. Use of Spanish themes and intrigues and attention to problems of the married woman, both important features of Restoration comedy, and the vogue of French culture and manners at the Court of Charles II explain this success.

238 pages. \$2.98. MicA54-3078

**J. W. De FOREST AND THE AMERICAN
SCENE: AN ANALYSIS OF HIS LIFE
AND NOVELS**

(Publication No. 10,145)

Edward Robert Hagemann, Ph. D.
Indiana University, 1954

The objectives of this study are (1) to present John William De Forest as man and writer, (2) to present his novels, and other pertinent writings, for analysis and discussion, and (3) to treat the dominant themes and techniques in his novels. It is not the aim of this study to discuss De Forest primarily as realist; various brief studies of him by Professors Quinn, Cowie, McIntyre, and others, have sufficiently made clear De Forest's contributions to realism in the United States. This study does not, however, fail to stress certain of De Forest's achievements which are early in the articulate development of the American novel, such as an early presentation of the witch trials in Salem (*Witching Times*), a serious treatment of war (*Miss Ravenel's Conversion*), a mature study of the American political scene (*Honest John Vane* and *Playing the Mischief*), and a significant portrayal of a Negro (*The Bloody Chasm*).

Because of De Forest's relative obscurity, it was necessary to commence the dissertation with a short and comprehensive biography which stresses his failure to gain recognition or attention from the reading public. His life is divided into five periods: 1826-1861, 1861-1868, 1868-1881, 1881-1898, and 1898-1906.

Chapters Two through Seven are concerned with an analysis of themes and techniques in De Forest's twelve novels and a discussion of his important contributions to the American novel in general. The dominant themes which emerge are four in number: the land-shark, the missionary from off the waters, secession, and the commentator who usually serves as De Forest's mouthpiece. These themes appear in his first novels and reappear, in various guises, in his succeeding novels.

Acknowledgement is made of De Forest's concern over "The Great American Novel" ever being produced, and emphasis is placed on the idea that the sum total of his novels is "The Great American Novel," each work adding, as it were, a chapter to the finished, although amorphous, product. Equal consequence is attached to a group of five of De Forest's novels, placed within the framework of his larger accomplishment, in which he depicts the assaults of witch hunts (*Witching Times*), war (*Miss Ravenel's Conversion*), slavery and Southern chivalry (*Kate Beaumont*), and politics (*Honest John Vane* and *Playing the Mischief*) on the ideal of America as he visualized it. These five novels are regarded as his most significant, artistically and thematically.

In the last chapter, using a series of letters written to William Dean Howells, the only critic in the United States to give De Forest his just due, as the basis for what is said, a final estimate is given the man and his work. The letters show to what despair and exile De Forest was driven in his later years when he was bitterly aware, as are most scholars and critics today, that he had been an important voice in American literature in the nineteenth century.

310 pages. \$3.88. MicA54-3079

THE CONTEMPT OF THE WORLD: A STUDY
IN THE IDEOLOGY OF LATIN CHRISTENDOM
WITH EMPHASIS ON FOURTEENTH
CENTURY ENGLISH LITERATURE

(Publication No. 9715)

Donald Roy Howard, Ph. D.
University of Florida, 1954

One of the most important features of western culture in its historic continuity has been the opposing and interacting relationship, which may be called a "polarity," between two concepts: one of these is the "humanistic" attitude that man and the world are of worth and significance; the other is "asceticism," the attitude that the world and man are corrupt and should be scorned in preference to the other-worldly. These two concepts, considered in their relationship of "polarity," account for some of the basic developments of western thought. The emphasis upon the "humanistic" rather than the "ascetic" was the essential characteristic of the Renaissance; but that emphasis was acting against a persistent tradition in the ideology of the Middle Ages - "the contempt of the world" - which was preserved in literary documents, themes, and motifs as well as in the terms of

common speech. This tradition gave harsh utterance to the attitude that the world and man were corrupt and transitory and therefore to be despised. While the existence of this tradition has long been a part of general knowledge, the present study is the first systematic treatment of it.

The contempt of the world thus lies at the roots of western thought. It was found in varying forms in Graeco-Roman philosophical and religious opinions, the combination of which is especially notable in Boethius; in Christianity it received its fullest and most complex expression in the writings of St. Augustine. Throughout the Middle Ages it existed as a persistent theme, usually employing an associated concept by which sins were grouped into three basic categories, "the lust of the flesh," "the lust of the eyes," and "pride of life." Certain stock themes and motifs accrued to these ascetic writings in the tenth and eleventh centuries in the works of such figures as St. Peter Damian, Hugo of St. Victor, St. Bernard of Clairvaux, and St. Anselm. In the twelfth century there were a number of significant writings - notably those of Bernard of Morval and Pope Innocent III - which fall into the genre. While these writings embody an attitude often regarded as typically medieval, they themselves reflect a growing worldly interest, a growing and uneasy awareness of the conflict between worldly attractions and ascetic strictures.

An understanding of this tradition greatly enhances our interpretation of the literature of the later Middle Ages and the Renaissance. The themes, motifs, and terms associated with the tradition tended to break away from the original context and become the subject matter of individual works. Mingled with humanistic and naturalistic concepts and themes, such as those found in Bernard Silvestris or the *Roman de la Rose*, they play an important part in the three principal literary documents of fourteenth century England - the works of Chaucer, *Piers the Plowman*, and *Sir Gawain and the Green Knight*. Beyond that, their influence was felt throughout the Renaissance. They reflect the heightened awareness of the conflict between the worldly and ascetic which characterized that age, and in the writings of Italian humanists - notably Fazio and Manetti - they were named and refuted. These refutations, however, took the form of an emphasis upon St. Augustine's reconciliation of the two opposing attitudes, and upon traditional arguments of Christian writers for the dignity of man. The change - one of emphasis and proportion rather than a supplanting or synthesizing of one attitude with the other - exemplifies the peculiarly slow and fluctuating evolution which characterizes the history of ideology and culture.

259 pages. \$3.24. MicA54-3080

THE USE OF GREEK MYTHOLOGY IN THE
FRENCH THEATER FROM 1918 TO 1948

(Publication No. 10,083)

Mary Frances McFeeters, Ph. D.
Syracuse University, 1954

Since the end of the first World War, adaptations from Greek mythology have been a familiar sight on the French stage. Although such adaptations have been a constantly recurring element in the French theater, the recent use of myth is significant not only because of the quality of a number of individual plays but also because this movement now entered into the main current of dramatic activity.

The movement gained momentum in the 1920's with Cocteau's *Antigone* (1922), *Oedipe-roi* (1925), and with Giraudoux's *Amphitryon 38* (1929). It attained proportions of a noteworthy element after 1930 with Gide's *Oedipe* (1930), Lenormand's *Asie* (1931), Cocteau's *La Machine infernale* (1932), and Giraudoux's *La Guerre de Troie n'aura pas lieu* (1935), and *Electre* (1937). It reached a climax of activity during World War II with Anouilh's *Eurydice* (1941) and *Antigone* (1942), Sartre's *Les Mouches* (1943), and Neveux's *Le Voyage de Thésée* (1943). Since 1945 have appeared Druon's *Mégarée*, Maulnier's *La Course des rois*, Anouilh's *Médée*, and Ghéon's *Oedipe*.

The purpose of this study is to discover how the modern playwrights have altered the myths, what they have found in them of significance to modern life, and why they have been attracted to them.

Chapters II through VII deal with an analysis of the dramatists' use of their materials. The liberty with which they treat their sources is striking. They add or subtract incidents at will, alter the characterization, shift the center of interest. They are generally more concerned with presenting ideas than with bringing characters to life. Their dramas afford an appeal more intellectual than emotional.

In Chapters VIII and IX, a synthesis of the ideas that recur throughout the plays reveals a general concern with the problems of man's relation to himself, to society, and to the universe. The dramatists emphasize the need for authenticity, self-discipline, heroic effort, and action. The majority agrees that man should accept his responsibility as a member and leader in society. They also probe the metaphysical problems of man's relation to his "gods" and reveal a desire to vindicate man's free will in his struggle against destiny.

Why are modern dramatists attracted to Greek mythology? One reason lies in the relation of these adaptations to new theories of dramatic art. A new *ars dramatica*, promoted in the inter-war period by such directors as Copeau, Pitoëff, Dullin, Jouvet, and Baty, and seconded by such writers as Gide, Giraudoux, Artaud, and Cocteau, called for a deliberate removal of the scene from contemporary existence, and for the creation of a "total theater" through collaboration of many arts. Adaptations from Greek mythology fit naturally into this trend; removed from contemporary life, they lent themselves easily to stylization and the techniques of the "total theater."

An equally important reason is that the myths served as apt media for the presentation of the above-mentioned moral and metaphysical problems. Dissatisfaction with the rigidity of determinism led the dramatists to turn to myth to illustrate the dignity and heroism of man. The most popular Greek sources are the tragedies of Sophocles. Modern writers, preoccupied with man's struggle with the "gods," have turned to Sophocles and his vision of heroic man facing adverse destiny. This need for a reaffirmation of free will and for a redefinition of man's responsibilities became acute after the fall of France in 1940. And there was at that time a corresponding increase in the number of dramas borrowed from Greek sources. 445 pages. \$5.56. MicA54-3081

POE'S ENGLISH BIOGRAPHER: JOHN HENRY
INGRAM, A BIOGRAPHICAL ACCOUNT AND
A STUDY OF HIS CONTRIBUTIONS TO
POE SCHOLARSHIP

(Publication No. 9657)

John Carl Miller, Ph. D.
University of Virginia, 1954

More than anything else in his life, John Henry Ingram wanted to be remembered as the one authentic Poe biographer in all the world. He succeeded in so many of his undertakings, by virtue of his genuine ability and unremitting industry, that it is almost ironical he did not succeed in the one endeavor most important to him, particularly since the necessary raw materials for building such an enduring monument were his to command, in an abundance peculiar to him as they never were to anyone else.

John Ingram's first publication was a poem in imitation of Poe's "Ulalume," published in 1863, and his last writing was a biography of Poe completed in 1915, though not published. He filled the fifty-two years in between indefatigably writing letters to those persons in America who had known Poe, searching for new material, publishing and republishing Poe's tales, essays, and poems, and writing prefaces, new memoirs, and biographies of Poe. In addition to his work on Poe, Ingram published sixteen volumes and a large number of magazine articles on other literary subjects, and worked for thirty-five years in the London General Post Office as a Civil Service employee.

When John Ingram died in 1916, his Poe library consisting of about 5000 letters, manuscripts, books, documents, magazines, and newspaper clippings was purchased by the University of Virginia. From this material Ingram had written three biographies of Poe, nearly fifty magazine articles, and edited and published eight separate editions of Poe's poems, tales, and essays. It was Ingram's happy inspiration, in the early 1870's, to reach those persons who had known and loved Poe, and some who had hated him, and to garner from them their memories and keepsakes. By his fortuitous timing, since many of Poe's friends were hastening to the grave, Ingram was able

to make his greatest contributions to the world's knowledge of Poe. These friends of Poe's made it possible for John Ingram, working 3000 miles from his sources of information, to establish a reputation as the leading Poe scholar and biographer, and to maintain that position for nearly thirty years.

By examining Ingram's important biographies and articles on Poe, in conjunction with the rough materials out of which he shaped them, it is possible to make a juster estimate of Ingram's value as a Poe editor and the importance of his work in the peculiarly difficult field of Poe scholarship. In addition, since Ingram's work on Poe covered nearly the whole span of his lifetime, it is possible to trace, in the great mass of his working papers, a thread of his biography.

This study is not a detailed biography, but it contains in large outline the story of John Ingram's career as an author, editor, and business man, and is a close, detailed study of the many important contributions he made to Poe scholarship.

The preface is an account of the acquisition of the Poe-Ingram Papers by the University of Virginia, and a description of them, and the first chapter is the story of John Ingram's beginning years as a writer.

The next five chapters deal with Ingram's preoccupation with Poe, his methods of collecting materials, his relationships with Poe's friends, his warfare with other Poe biographers, and his writing on Poe and edition of Poe's works. The last chapter is a critical evaluation of John Ingram as a Poe editor and scholar. Two special bibliographies are appended: one listing books and magazine articles that Ingram published about Poe, and the second listing those books and articles he published on other subjects.

John Ingram brought more fervor, even passion, to his work on Poe than did anyone else, and his active participation as a Poe scholar and editor stretched over a longer period of time than has anyone else's. He has to his credit, too, a complete body of work on Poe, immeasurably larger than that done by any other editor. Ingram first called Rufus Wilmot Griswold a forger - and proved it. And it was Ingram who drew around him that group of women who had known Poe better than anyone else had known him: Mrs. Sarah Helen Whitman, "Annie" Richmond, Marie Louise Shew-Houghton, "Stella" Lewis, Mrs. Mary Gove Nichols, Elmira Royster Shelton, and Miss Amelia Poe; and from them elicited intimate and authentic information about Poe which he was able to place forever on the record. It was Ingram who first discovered a copy of Poe's *Tamerlane* in 1847 in the British Museum, and who, by amazing dexterity first assembled all four of the volumes of poems published by Poe, and presented the first bibliographical study of them; it was he who first discovered that Poe was the author of "The Journal of Julius Rodman"; and it was he who became the custodian of the largest number and greatest variety of original Poe letters ever entrusted to a Poe biographer. To the peculiar quality of Ingram's blazing

devotion to his work on Poe, and to his triumphs in it, is due much scholarly credit.

330 pages. \$4.13. MicA54-3082

CONTEMPORARY CRITICISM OF THE WORKS OF SAMUEL JOHNSON

(Publication No. 9719)

Ira Lee Morgan, Ph. D.
University of Florida, 1954

The contemporary criticism of the works of Samuel Johnson is voluminous, appearing in many different forms - reviews and articles in periodicals, letters, diaries, journals, memoirs, biographies, poems, dictionaries, pamphlets, and books devoted solely to that purpose. It reveals that, by and large, Johnson was regarded not as a vivid personality alone, but as a significant writer, perhaps the most significant of the eighteenth century, and that his high reputation in that period was to a great degree the result of his writings.

As a poet, Johnson was ranked with Pope; as an essayist, with Addison. His only drama, *Irene*, failed for the lack of pathos. *Rasselas* was commended for its moral, rather than for any merit as a novel. Though criticism of the *Dictionary* was loud, praise was louder, and many of Johnson's contemporaries considered it the outstanding literary achievement of the century. The best Shakespearean scholars, while recognizing Johnson's indolence in collating and general deficiency in research, pronounced his edition of Shakespeare a creditable one. His political pamphlets were, on the whole, excoriated. Numbers of Scots took offense at passages in his *Journey*, but most critics thought it an interesting and entertaining book, rendered especially valuable for the philosophical discussions which it contained. As a biographer and critic, Johnson was compared with Plutarch and Aristotle and Longinus. Many writers commented with severity on Johnson's various personal prejudices which appeared in the *Lives*, but the consensus was that the work was a brilliant array of biography and criticism.

There is abundant evidence to show that the major attacks on Johnson's writings were in many cases directed principally against his personality by people who differed from him politically, religiously, philosophically, and nationally. On the other hand, the frequent panegyrics on his works may usually be credited because those who recorded them also mentioned his faults as a writer and as a man.

For the most part, Johnson's contemporaries considered him a literary conservative both in theory and practice, and, as a rule, emphasized his neoclassic qualities when praising and censuring him and slighted his liberal tendencies.

439 pages. \$5.49. MicA54-3083

THE IDEAS OF BENJAMIN DISRAELI,
LORD BEACONSFIELD

(Publication No. 10,156)

Olive Wrenchel Parsons, Ph. D.
Indiana University, 1954

The purpose of this study has been, first, to codify the historical, political, racial, and religious ideas of Benjamin Disraeli as they appear in his novels and tales, his political biography of Lord George Bentinck, his *Vindication of the English Constitution*, and his other political writings, and in his speeches — both in Parliament and out. Second, the purpose has been to show that these ideas comprise what may loosely be called a philosophy in which Disraeli had a deep and abiding faith and by which he sought to govern the British Empire. No one heretofore has made these ideas the central focus of his work or has attempted an ambitious codification of them.

Three fundamental facts are essential to the comprehension of Disraeli's ideas: Disraeli was a Jew; he believed imagination to be superior to reason; and he proclaimed the individual, and not society, to be of paramount consideration. These facts account largely for his unusual theory of race and religion; his antagonism to the doctrine of the natural equality of man; and his antipathy to Utilitarianism (more especially Benthamism) and materialism.

In this study, for the first time, it is shown that Disraeli's theory of history and politics, outlined in the *Vindication*, can be reduced to five main tenets: that liberty and the political institutions of England are the growth of ages, developing naturally from the course of events and having their source in the national genius and character; that the English constitution has established a complete democracy; that the basis of an efficient and enduring representative government is its representation, not necessarily by election, of every important and permanent interest of the country; that the House of Commons is not the House of the People; and that, in the efficient system of parties in England, the Tories are the national, democratic party, whereas the Whigs are anti-national and oligarchical.

An analysis of *Coningsby*, *Sybil*, and *Tancred* shows the development through Young England of the historical and political theory of Disraeli and discovers many other reflections of Young England in this trilogy. His historical and political theory culminated in Tory Democracy. His political activities from his overthrow of Peel in 1846 to his own final defeat in 1880 reveal this theory in practice and show that, through Tory Democracy, it became an actual force in the government of the British Empire.

The great motivating effect on Disraeli of his racial and religious theory has not been generally recognized. As he put his historical and political ideas into practice through Tory Democracy, this study shows, so he applied his racial and religious ideas to the affairs of Church and State, in support of civil rights for Jews, and in his own private worship.

437 pages. \$5.46. MicA54-3084

THE NEGRO IN BRAZILIAN
FICTION SINCE 1888

(Publication No. 10,182)

Gregory Rabassa, Ph. D.
Columbia University, 1954

The Negro has been an important character in Brazilian literature since the inception of slavery in 1531. Early chroniclers described the impact of slavery and the society which resulted. In the eighteenth century there came anti-slavery writings, later coupled with Romanticism. In the nineteenth century the Negro assumed an even more important position since the slavery issue had become intricately involved with the question of Brazil's form of government. The novel reached its maturity with the Realists and Naturalists and we have our first true and balanced portrait of Negro life.

This study begins with the abolition of slavery in 1888. Coelho Neto continued the realistic current of his predecessors, although his novel *Rei negro* has many Romantic elements. It is the most successful early effort to devote a full-length novel to the plight of the African in Brazil. With Graça Aranha racial concepts are introduced. Here the emphasis is upon theoretical matters rather than a true-to-life exposition of race relations in Brazil.

The section of Brazil known as the Northeast, with its extensive agricultural development has been a center of Negro population dating from the days of slavery. An extensive study of the novels of José Lins do Rego and others serves as an examination of typical Northeastern novels. There are numerous Negro characters in these works, some of them being protagonists. Jorge Amado best typifies the novel of the Bahia region. Despite the author's political intent he never deserts his position as novelist and we are given a clear picture of the part played by Negroes in the life of this region, both rural and urban. In his works Negroes are apt to have important roles. In the novels of Amado and other Bahian writers there is a marked interest in Negro folklore, with extensive descriptions of various religious ceremonies.

Although novelists of southern Brazil tend to write more about urban life, there are works dealing with the interior. Novels about the poorer classes are apt to include many Negro characters. The outstanding writer of Rio de Janeiro is Lima Barreto, a Mulatto. One can see a deep interest in race relations and a certain bitterness about the Negro's lot. The historical novel dealing with Negroes often takes place in southern Brazil.

At times the Negro is the center of interest, often the protagonist, and his problems are those emphasized by the work. Elsewhere he appears as a background figure. He is endowed with both good and evil traits, depending upon the viewpoint of the author. Some novelists delve into aspects of Negro folklore and tend to be more descriptive than narrative. To many the racial question is of such small importance that it is often difficult to deduce the race of various characters. Although Negroes may assume great

importance in the Brazilian novel, there is no such thing in Brazilian fiction as a movement devoted to the Negro. 297 pages. \$3.71. MicA54-3085

search for a coherent and satisfying faith was unsuccessful, and she finally sought to validate in art the moral order she could not discover by rational examination of the external world.

228 pages. \$2.85. MicA54-3086

GEORGE ELIOT: HER SEARCH FOR ORDER

(Publication No. 9800)

Robert Lee Schneider, Ph. D.
Cornell University, 1954

Basil Willey, in his studies of nineteenth-century thought, wrote of George Eliot that "her development is a paradigm, her intellectual biography a graph, of its (the century's) most decided trend." That trend was a compound of two major currents: growing acceptance of a mechanistic conception of the cosmos, and strenuous effort to find in that conception some sanction for human values. She and her contemporaries lived before mechanistic determinism had been extended to include the human will, but they nevertheless recognized the need for some reconciliation of rational conclusions with emotional necessities, of universal change with permanent order. They dedicated themselves with self-conscious but hopeful seriousness to the task of effecting that reconciliation, encouraged by their belief that the essence of religious truth was not contradicted by scientific discoveries, that history was a process by which truth was revealed more and more completely to men who were becoming more nearly perfect all the time.

As is well known, George Eliot was profoundly influenced by scientific rationalism, especially by that version of it which is known as positivism, but her vision of life was also determined by her uniquely personal experience; the influence of her childhood and adolescence in the rigidly conventional and conservative society of rural Warwick survived her break with Christianity in 1841 and her violation of the social code in 1854, and exerted itself with renewed power after she began to write fiction.

Most studies of her thought have implied that she used fiction to inculcate a static philosophy; even perceptive critics have often treated her work as though there were an unvarying rigidity of both meaning and technique in all her novels. The truth is that her moral attitudes changed significantly as she lived and wrote, and that her fiction reflected the changes. This study is an attempt to show, with reference to each of her novels and the time at which it was written, how her fiction was affected by, and how it helped to produce, modifications in her intellectual and moral outlook.

She found that science is not an adequate substitute for religion and that life apart from a coherent social order can not be morally satisfying. If her intellectual biography up to 1856 is a graph of her century's most decided trend, her subsequent history as an artist and moralist isolated from the institutional life of her time anticipates difficulties characteristic of the present century, and gives her work prophetic relevance for the modern reader. Her lifelong

THE SHORTER NARRATIVE POEMS OF EDWIN ARLINGTON ROBINSON

(Publication No. 9199)

Alan Archer Stephens, Jr., Ph. D.
University of Missouri, 1954

Robinson's shorter narratives comprise an important segment of his work, and it was the purpose of this study to treat these poems exhaustively, primarily from the formal and technical standpoint. In order to achieve the necessary exactness in terminology, an introductory chapter was devoted to the traditional elements of narrative and their relations to one another: theme, narrative order, action, character, point of view, and setting. The relation of the narrative form to other forms of discourse, and to the writer's general outlook, was also described.

Robinson is generally considered to be a consistently traditional poet, but a careful study of his techniques in the shorter narratives reveals that this is not wholly true, that, on the contrary, Robinson engaged in experimental practices in a number of poems. Indeed, in work such as "The Unforgiven," "The Whip," "Haunted House," and "Richard Cory," Robinson attempted to break down the traditional narrative scheme quite as drastically as Pound, Eliot, and Joyce - writers who are universally recognized as experimentalists. Robinson's experimental techniques consisted chiefly in blocking out or suppressing certain of the elements of the traditional narrative, and attempting to make the remaining elements perform the whole task of the narrative by way of implication. The intended result appears to have been extraordinary compression and immediacy; but the actual result is commonly an obscuring of the subject from which the compression and immediacy must derive their force.

The experimental narratives fall into two groups: first, those in which the action is external, brief, and violent, character briefly delineated, and point of view strictly external; and second, those in which the action is internal, extended, and slight, character elaborately investigated, and point of view chiefly internal. The prototype of the first sort is "Richard Cory," of the second sort, "The Unforgiven."

In the traditional narrative form Robinson was a master. His greatest work - "Eros Turannos," "As It Looked Then," "Alma Mater," "The Growth of 'Lorraine'," and others - demonstrates his ability to employ the elements of narrative in perfect balance, exploiting their potentialities to the utmost within extremely brief compass.

In the course of the study the New England heritage was shown to have a particular effect on Robinson's characters, themes, and the narrative action;

the Transcendental tradition on his themes and the narrative order; the Romantic tradition on his uses of setting and his themes.

Seen as a whole, Robinson's work in the short narrative poem gives evidence of the same persistence and consistency with which he lived out his life. Certain subjects – man and woman trapped in irre-mediabile misunderstanding, the effects of gossip, the effects of the past on the present – Robinson returned to repeatedly, sometimes attacking them with experimental means, sometimes with traditional means. His experiments appear to be less attempts to escape the traditional than attempts to test the traditional by isolating certain of its elements and putting them under the strain of extreme burdens. When he returned to the traditional narrative, it was with full knowledge of what it was capable of doing, and with perfect mastery over it. 235 pages. \$2.94. MicA54-3087

**THE PRAIRIE SCHOONER: A LITTLE
MAGAZINE'S FIRST TWENTY-FIVE YEARS**

(Publication No. 9152)

Paul Robert Stewart, Ph. D.
University of Illinois, 1954

The importance of the American little magazine in the stimulation and shaping of modern literature has long been recognized by American writers. In 1946 it was also recognized by scholars, with the publication of *The Little Magazine*, by Frederick J. Hoffman, Charles Allen, and Carolyn Ulrich (Princeton University Press). Excellent though that work is, its broad scope makes it necessarily somewhat general. The present study has been undertaken in the belief that a fuller understanding of the little magazine may be gained through focusing on one magazine and analyzing it in some detail. This study of the *Prairie Schooner's* first twenty-five years (1927 through 1951) is based primarily upon the contents of the *Schooner*, more than two thousand letters, newspaper files, and personal interviews with Dr. Lowry C. Wimberly (editor of the magazine since its inception) and others associated with the *Schooner*.

The financial history of the *Schooner* demonstrates the difficulties commonly encountered by a little magazine. It originated as a campus quarterly sponsored by the University of Nebraska chapter of Sigma Upsilon. It began publication with the aid of a \$200 grant from the university, and it has struggled ever since

to avoid financial collapse. Its early sales were primarily to the university population. With the aid of favorable publicity from such critics as Edward J. O'Brien, it soon began to find readers throughout the nation, but the gain thus effected was more offset by a decline in campus enthusiasm. Only through frequent sales drives has it managed to stay near a paid circulation of five hundred, and it has constantly depended upon small university subsidies to remain alive.

Editorially, the *Schooner* is generally called "regional," but such a designation is misleading. It was founded primarily as an outlet for University of Nebraska students and other midwestern writers, and, with Wimberly's insistence that an author write from his own experience and environment, it did reflect the Midwest during its early years. Indeed the contents of the early *Schooner* are useful in defining Midwestern regionalism. But it was soon attracting writers from distant points (it has printed writers from forty-six states and fifteen foreign countries, territories, or provinces), and hence it lost its strong regional emphasis. Through most of its career its policy has been eclectic. Though best known for its short stories, it also publishes poetry and expository prose. Wimberly, with the aid of Frederick L. Christensen, selects from available manuscripts those which he considers intrinsically the best. In making his selections, he seeks sincerity, intelligibility, and significance.

During its first twenty-five years, the *Schooner* carried the work of 1,080 contributors. Most of them had published little if any before their appearance in the *Schooner*. They received no money for their efforts, but, largely because commercial publishers watch the little magazines closely, they benefited in other ways – acknowledgement, reprints, and invitations to contribute elsewhere. Several of them have gone on to successful writing careers.

The approximately 24,000 other writers whose work Wimberly has been forced to reject have also benefited, from Wimberly's criticism, his encouragement, and his efforts to direct them to other markets. Through close cooperation with other magazines, he has been able to further the careers of some writers whom the *Schooner* has never printed.

Wimberly has received no money for his long years of hard work on the *Schooner*, and very little recognition. Yet there is no doubt that he, together with editors of other little magazines, has rendered American literature an invaluable service.

268 pages. \$3.35. MicA54-3088

MATHEMATICS

THE TOPOLATTICE AND PERMUTATION GROUP OF AN INFINITE SET

(Publication No. 9537)

Robert Waller Bagley, Ph.D.
University of Florida, 1954

The lattice of all T_1 topologies on a given infinite set S is considered. It is denoted by Λ . A mapping F of $\Lambda \otimes \tilde{\Lambda}$ (where $\tilde{\Lambda}$ denotes Λ dually ordered) into the two element chain $\{0,1\}$ is said to be induced by a permutation f of S if $F(\alpha, \beta) = 0$ if and only if f is continuous under the pair (α, β) in $\Lambda \otimes \tilde{\Lambda}$. A set of necessary and sufficient conditions that a mapping F be induced by a permutation of S is established. This result is applied to group theory.

33 pages. \$1.00. MicA54-3089

ON THE DESIGN AND COMPARISON OF CERTAIN DICHOTOMOUS EXPERIMENTS

(Publication No. 9478)

Russell Newton Bratt, Ph.D.
Stanford University, 1954

A researcher, wishing to decide which of several alternatives to accept, may find that there are several experiments available to him which he might perform to guide him in reaching his decision. He is faced with making a preliminary decision as to which experiment or experiments he is to perform. If he admits the possibility of performing more than one experiment, then the questions of how many, which ones, and in what order, arise. Such questions come under the heading of comparison and design of experiments.

While much of the general theory of the design problem has been developed, solutions of particular problems, especially of the sequential type, have not been obtained. This paper stems from work towards solving the design problem for certain dichotomous experiments. It is supposed that one of two hypotheses, H_1 and H_2 , is true and that one must decide which is the true one, suffering a loss of one unit if the decision is incorrect and no loss otherwise. It is supposed that X and Y are two random variables having known densities f_i and g_i , respectively, under hypothesis H_i . Using the criterion of minimizing the Bayes risk, the general question is whether it is better to base the decision on an observation of X or on an observation of Y .

In Section 2, conditions that the risks associated with X be uniformly less than those associated with Y

are derived. If $R_Z(\zeta)$ denotes the Bayes risk when observing random variable Z and ζ is the a priori probability that H_1 is true, the following two conditions are each necessary and sufficient that $R_X(\zeta) < R_Y(\zeta)$:

$$(i) \int_0^{\infty} \min[u - \frac{\zeta}{1-\zeta}, 0] dE(u) < \int_0^{\infty} \min[u - \frac{\zeta}{1-\zeta}, 0] dF(u);$$

$$(ii) \int_0^{\infty} \min[1 - \frac{\zeta}{u(1-\zeta)}, 0] dG(u) < \int_0^{\infty} \min[1 - \frac{\zeta}{u(1-\zeta)}, 0] dH(u);$$

where E and G are the c.d.f.'s of $f_2(x)/f_1(x)$ and F and H those of $g_2(y)/g_1(y)$ under H_1 and H_2 , respectively. That the two risks be identical it is necessary and sufficient that the two likelihood ratios have the same distribution under each hypothesis.

Relations between uniform inequality between the risks and inequalities between the corresponding information numbers for X and for Y as defined by Kullback and Leibler are investigated. It is shown that if $R_X(\zeta) \leq R_Y(\zeta)$, uniformly, then the Kullback-Leibler information numbers for X are greater or equal to the corresponding numbers for Y . The case in which each of the distributions is normal is considered in some detail and furnishes an example in which the information numbers for X may be greater than those for Y but $R_X(\zeta)$ fails to be uniformly less than $R_Y(\zeta)$.

Section 3 is devoted to the problem of designs in the case of binomial distributions. Let the two experiments, X and Y be independent and of equal cost and the number of observations, n , be fixed. The optimal division of the sample between X 's and Y 's is discussed. Certain general conclusions for ζ near 0 or near 1 are found and the complete solution for small n is given. For the sequential design for this problem, a method for obtaining the optimal rule in an inductive fashion for given parameter values is given. Complete general solutions appear to bog down quickly in a morass of cases as n increases.

In Section 4, instead of considering performing a fixed number of experiments, the experimentation is supposed terminated by a particular sequential stopping rule and the problem of finding a sequential design which minimizes the expected number of observations is considered. In the final section it is supposed that a fixed number of observations is allowed and a sequential design is sought which will maximize the sum of the observed rules. In particular, that design which requires at each step the choice which will maximize the expected value of the next observation is investigated and is shown to be consistent.

56 pages. \$1.00. MicA54-3090

NOETHERIAN MINIMAL BASES AND EQUATIONS WITH PRESCRIBED GROUPS

(Publication No. 9857)

Charles Francis Brumfiel, Ph.D.
Purdue University, 1954

Major Professor: Ralph Hull

This dissertation deals with the converse problem of Galois theory, namely, the determination of equations with prescribed groups. The treatment is along the lines of the minimal basis method initiated by E. Noether. Emphasis is placed upon the proof of the existence of parametric representations yielding the totality of equations with prescribed groups for a specified field, rather than the actual construction of such parametric representations. The work of earlier writers is summarized, and some new results are obtained. 92 pages. \$1.15. MicA54-3091

ON A CLASS OF NON-LINEAR PARTIAL DIFFERENTIAL EQUATIONS

(Publication No. 10,065)

Sullivan Graham Campbell, Ph.D.
Syracuse University, 1954

Although the field of non-linear partial differential equations is one of the oldest areas of mathematical analysis, there does not exist even the beginning of a satisfactory general theory for dealing with such equations. Developments in the past have concerned primarily particular results about particular equations which were generally of importance in some physical or geometrical sense.

Modern science, modern technology, and modern mathematics have all placed increased emphasis on non-linear problems to such an extent that the development of a more comprehensive general theory for dealing with such problems has become a matter of considerable importance. One of the steps toward the development of such a theory is to extend and generalize existing results in the hope that some sort of comprehensive pattern will eventually emerge.

This paper is concerned with such a problem. One of the oldest and best known non-linear partial differential equations is the minimal surface equation, which has been studied intensively by many of the outstanding mathematicians of the past two centuries. Yet many of the most important results concerning this equation have been achieved only recently. In addition to its well-known geometrical properties, the minimal surface equation exhibits an intimate connection with the theory of analytic functions of a complex variable and with fluid dynamics. It is the purpose of this paper to investigate a generalization of the minimal surface equation due to Prof. Abe Gelbart of Syracuse University.

The non-linear partial differential equation

$$(1) \quad (F^2 + \Phi_x^2)\Phi_{yy} - 2\Phi_x\Phi_y\Phi_{xy} + (F^2 + \Phi_y^2)\Phi_{xx} - FF'(\Phi_x^2 + \Phi_y^2) = 0$$

where Φ is a twice continuously differentiable function of the independent variables x and y , and F is a continuously differentiable function of (Φ) , is obviously a generalization of the minimal surface equation, to which it reduces when F is identically 1.

A one-to-one correspondence between the solutions of (1) and the solutions of the minimal surface equation is shown, and the entire solutions of (1) are characterized both analytically and geometrically. It is shown that a non-trivial set of such solutions exist, and how to construct them. Geometrically, the entire solutions of (1) turn out to be developable surfaces, characterized analytically by the equations $\Phi_x = a$, $\Phi_y = b$, where a and b are constants. All such functions Φ are of the form $\Phi = E(ax+by)$, E being an entire function of the single real variable $t = ax+by$. (The term "entire function" is used here to denote a function which possesses continuous derivatives of all orders for all finite values of the independent variables.)

Necessary and sufficient conditions that (1) possess an entire solution are given, and several examples are considered in detail. It is also shown that if $F(\Phi)$ is an analytic function of Φ which does not vanish, then any solution Φ of (1) which is twice continuously differentiable in a domain D is analytic in D . 42 pages. \$1.00. MicA54-3092

MOTION GROUPS OF PLANES

(Publication No. 9060)

Arno Cronheim, Ph.D.
University of Illinois, 1954

We consider a group G , generated by a distinguished set of involutions, $\lambda = (a,b,c, \dots)$, called "lines." If $a \neq b$ and $ab = ba$, we say that $a \perp b$ ("perpendicular"). If $a \neq b$, we say that $A = ab$ is a "point" and that " A is on a ." We denote the geometric structure determined in this way by (G, λ) . We call G a "motion group" of (G, λ) , if it satisfies:

- (i) lines are mapped onto lines by inner automorphisms of G
- (ii) two distinct points are on one and only one line
- (iii) every line carries at least two points
- (iv) the center $Z(G)$ of G is 1.

G is isomorphic to a transformation group on (G, λ) .

If instead of (iv) we assume only that there are no lines in $Z(G)$, then $\bar{G} = G/Z(G)$ is a motion group with "lines" $\bar{\lambda}$, and (G, λ) and $(\bar{G}, \bar{\lambda})$ are isomorphic geometries.

If the point P is not on the line p and $pP = Pp$, we say that P and p are a pole-polar pair. The relation

pole-polar is 1-to-1, and actually $P = p$. (G, λ) is a projective plane if and only if there is a pole-polar pair on (G, λ) . If (G, λ) is a projective plane, then G is an elliptic group if and only if the product of three concurrent lines is always a line.

If G is a motion group, we call $L(p)$ the set of all $x \perp p$, $G(p)$ the group generated by $L(p)$, and $Z(p)$ the center of $G(p)$. The image of $L(p)$ in $\bar{G}(p) = G(p)/Z(p)$ is a set of involutions which generate $\bar{G}(p)$. The map of $L(p)$ into $\bar{G}(p)$ identifies only perpendicular lines.

Suppose there are given a field F , a projective plane π over F , and involutorial anti-automorphism α of F , an α -form f over π such that $f(x, x) = 0$ only for $x = 0$; then the unitary group $U = U(F, f)$ is determined. Let λ be the set of those involutions in $U/Z(U)$ which leave a pole-polar pair on π pointwise fixed. Then $G = \{\lambda\}$ is a motion group of π . If F is commutative, λ is actually the set of all involutions in $U/Z(U)$.

If F is commutative (or a quaternion field), then $\bar{G}(p)$ satisfies (for any p in λ): if $\bar{a} \neq \bar{b}$, $\bar{a}\bar{b}\bar{c}$ in $\bar{L}(p)$, and $\bar{a}\bar{b}\bar{d}$ in $\bar{L}(p)$, then $\bar{a}\bar{c}\bar{d}$ in $\bar{L}(p)$. In particular, if F is of the form $F = K(\sqrt{-1})$ with Pythagorean K , then $\bar{G}(p)$ is an elliptic group.

Now take $F = K(\sqrt{D})$ with $\sqrt{D} \alpha = -\sqrt{D}$. Then an involution a in λ which is $\perp p$ is induced by

$$M_a = \begin{pmatrix} -1 & & \\ & r_0 & a_3(r_1 - r_2 \sqrt{D}) \\ & a_2(r_1 + r_2 \sqrt{D}) & -r_0 \end{pmatrix}$$

with r_i in K , $r_0^2 + a_2 a_3 (r_1^2 - r_2^2 D) = 1$, and with $f(\xi, \xi) = \sum a_i \xi_i^2$. We get a 1-to-1 map ϕ from $\bar{L}(p)$ into a K -plane by $\phi(\bar{a}) = (r_0, r_1, r_2)$. Then $\bar{a}\bar{b}\bar{c}$ is in $\bar{L}(p)$ if and only if $\phi(\bar{a}), \phi(\bar{b}), \phi(\bar{c})$ are collinear. The form $f^\phi(r, s) = r_0 s_0 + a_2 a_3 r_1 s_1 - D a_2 a_3 r_2 s_2$ makes the K -plane under consideration into an elliptic plane such that $\bar{a} \perp \bar{b}$ if and only if $\phi(\bar{a}) \perp \phi(\bar{b})$. The structure of this K -plane is independent from the choice of D and the coordinate system. 30 pages. \$1.00. MicA54-3093

BIBLIOGRAPHY

F. Bachmann

Zur Begründung der Geometrie aus dem Spiegelungsbegriff. Math. Ann. vol. 123 (1951), pp. 341-244.

R. Baer

The group of motions of a two dimensional elliptic geometry. Compos. Math. vol. 9 (1951), pp. 241-288.

J. Dieudonné

Sur les groupes classiques. Actualités scientifiques et industrielles 1040, Paris, 1948.

E. Pödehl - K. Reidemeister

Eine Begründung der ebenen elliptischen Geometrie. Crelle vol. 186 (1949), pp. 230-240.

A. Schmidt

Die Dualität von Inzidenz und Senkrechtheiten in der absoluten Geometrie. Math. Ann. vol. 118 (1943), pp. 609-625.

ON THE EQUIVALENCE OF QUADRATIC FORMS

(Publication No. 9714)

Thomas Roscoe Horton, Ph.D.

University of Florida, 1954

A homogeneous polynomial expression of the second degree in three independent variables is called a ternary quadratic form. When a ternary form is subjected to a linear transformation (c_{jk}) , $j, k = 1, 2, 3$, of determinant one, the resulting form is said to be equivalent to the original one. This number theoretic dissertation seeks conditions that a general ternary quadratic form f with coefficients $a_{ji} = a_{ij}$, $i, j = 1, 2, 3$, and of determinant $d \neq 0$ be equivalent to a form f' with coefficients b_{sk} , $s, k = 1, 2, 3$, where the b_{sk} have certain restrictions placed on them. When $b_{13} = 0$ and $b_{23} = Kb_{33}$, a necessary and sufficient condition that f be equivalent to f' is that f represent primitively, when $x_j = c_{j3}$, $j = 1, 2, 3$, g or $-g$, where g is the g.c.d. of the values of the three linear functions $X'_{i3} = a_{i1}x_1 + a_{i2}x_2 + a_{i3}x_3$, $i = 1, 2, 3$, associated with the form f , when $x_j = c_{j3}$. Also it is necessary that $g = |b_{33}|$ and that f represent primitively a divisor of d . A necessary and sufficient condition for the equivalence of f and f' is that $g\phi(X_{13}, X_{23}, X_{33})$ be equal to d or $-d$, where $X'_{i3} = gX_{i3}$, $i = 1, 2, 3$, when $x_j = c_{j3}$, $j = 1, 2, 3$, and where ϕ is the adjoint form of the form f .

The conditions for equivalence furnished in this dissertation were obtained largely by Diophantine analysis.

It is shown that any form f of non-zero determinant is equivalent to a form f' with $b_{13} = 0$. A conjecture is made that any properly primitive form f of non-zero determinant is equivalent to a form f' with $b_{12} = N$, where N is any preassigned integer.

Preliminary to the establishment of further conditions for equivalence some lemmas concerning certain Diophantine equations were required. The non-homogeneous, linear Diophantine equation in three indeterminates, $ax + by + cz = d$, where (a, b, c) divides d , is solved and is shown, when $(a, b, c) = 1$, always to possess a primitive solution for any integer d . Associated with the form f , classic or non-classic, is the set of three linear functions $X'_s = a_{s1}x_1 + a_{s2}x_2 + a_{s3}x_3$, $s = 1, 2, 3$. It is shown that a primitive set of integers $x_1 = x'_1$, $x_2 = x'_2$, $x_3 = x'_3$ exists for which the g.c.d. of the three linear functions X'_s is one, provided that the form f is properly primitive.

A necessary and sufficient condition that a form f be equivalent to f' , where $b_{23} = 0$, $b_{13} = N$, and N is any preassigned integer, is that the g.c.d. of a certain three constants divide g . A sufficient condition that f be equivalent to f' is that the g.c.d. of the three constants, $Nc_{i3} - f_3c_{i1}$, $i = 1, 2, 3$, divide g , where $f_3 = f(c_{13}, c_{23}, c_{33})$.

It is proved that any properly primitive form f of determinant $d \neq 0$ which primitively represents one is equivalent to a form f' with $b_{13} = N$, $b_{23} = 0$, and $b_{33} = 1$, where N is any preassigned integer.

A theorem of E. H. Hadlock is quoted which gives a necessary and sufficient condition that f of determinant $d \neq 0$ be equivalent to a form f' with $b_{12} = b_{13} = b_{23} = 0$. The condition as given is used in obtaining transformations sending a particular form f into another particular form f' . A corollary to this theorem is given and is used in the study of automorphisms of the positive form f with no terms of type $2a_{ij}x_i x_j$, $i \neq j$, $i, j = 1, 2, 3$. By this corollary all automorphisms of f are obtained and are seen to agree with previously known results.

114 pages. \$1.43. MicA54-3094

ON FIELDS OF QUOTIENTS OF CERTAIN CONVOLUTION ALGEBRAS

(Publication No. 10,007)

Ted R. Jenkins, Ph.D.
University of Washington, 1954

Let \mathcal{L} denote the space of functions defined on $]-\infty, \infty[$ which vanish identically on $]-\infty, 0[$ and are integrable in the sense of Lebesgue over $[0, T]$ for all real numbers $T > 0$. With addition and multiplication defined by

$$(f + g)(x) = f(x) + g(x)$$

$$(f * g)(x) = \int_0^x f(x-y)g(y)dy,$$

modulo sets of measure zero, and with ordinary scalar multiplication by elements of the complex number field K , \mathcal{L} is a commutative associative algebra over K . A theorem due to E. C. Titchmarsh guarantees that \mathcal{L} contains no divisors of zero. Hence \mathcal{L} possesses a field of quotients.

The field of quotients of any algebra over K having no divisors of zero contains a sub-field isomorphic with K and hence may be regarded as an extension of K . In this paper we study the algebraic character of this extension, as well as the structure of certain algebras, including various well-known sub-algebras of \mathcal{L} .

It is proved, for every algebra A having at least one element algebraically independent with respect to K and no divisors of zero, that there exists a transcendence basis M for the field of quotients of A over K with $M \subset A$.

Let \bar{S} denote the algebra generated by the set S of all step functions defined in $]-\infty, \infty[$, such that the set of points on which each function in S differs from zero is a finite union of bounded, disjoint, half-open intervals of the type $[x_{j-1}, x_j[\subset [0, \infty[$. Let H de-

note the set of characteristic functions of such intervals and H' the subset of H consisting of those characteristic functions of intervals whose end points are elements from a Hamel basis for the real numbers over the rational numbers. It is proved that there

exists a transcendence basis M for the field of quotients of \bar{S} over K with $H' \subset M \subset H$.

Several classes of ideals of the sub-algebra $L_1[0, \infty[$ of \mathcal{L} are discussed. It is proved that $L_1[0, \infty[$ possesses a continuum of ideals which are linearly ordered by set inclusion; moreover, each is dense in the strong topology of L_1 and is contained in no proper closed maximal ideal. Convolution roots of order 2^n ($n = 1, 2, \dots$) are extracted of each function in a dense set of functions in $L_1[0, \infty[$; and it is proved that there exists a transcendence basis M' for the field of quotients of $L_1[0, \infty[$ over K with

$H' \subset M \subset M' \subset L_1[0, \infty[$ (H' and M as defined in the preceding paragraph).

The paper concludes with a discussion of the algebra K^N consisting of all functions with the non-negative integers N as domain and range $\subset K$. Addition and multiplication are defined component-wise by

$$(a + b)_n = a_n + b_n \quad (n = 0, 1, 2, \dots)$$

$$(a * b)_n = \sum_{j=0}^n a_j b_{n-j} \quad (n = 0, 1, 2, \dots).$$

The field of quotients of K^N is described and it is proved that this field is a transcendental extension of degree 2^{\aleph_0} of the complex number field.

71 pages. \$1.00. MicA54-3095

A STUDY OF STIELTJES INTEGRAL TRANSFORMS OF A CERTAIN CLASS OF FUNCTIONS

(Publication No. 9884)

Ralph Henry Niemann, Ph.D.
Purdue University, 1954

Major Professor: H. K. Hughes

This thesis is a study of an extension of the series

$$(1) \quad \bar{\Omega}(z) = \sum_{n=0}^{\infty} c_n \frac{g(z+n)}{g(z)} \quad [\Omega(z) = \sum_{n=0}^{\infty} c_n g(z+n)]$$

to a Stieltjes integral

$$(2) \quad f(z) = \int_0^{\infty} \frac{g(z+t)}{g(z)} dc(t) \quad [F(z) = \int_0^{\infty} g(z+t)dc(t)].$$

The function $c(t)$ is assumed to be of bounded variation in every finite interval $(0, T)$ and $g(z)$ is assumed to be analytic and single-valued in a sector, $-G_2 < \arg z < G_1$, of the complex plane. For values of z of large modulus in this sector, $g(z)$ has the asymptotic representation

$$(3) \quad g(z) \sim z^{P(z)} e^{Q(z)} \left(1 + \frac{a_1}{z} + \dots\right),$$

where the functions $P(z)$ and $Q(z)$ are polynomials of degree k and m respectively.

In a series of papers extending over the years 1916-1919, R. D. Carmichael studied series (1), which is a generalization of the well known factorial series

$$(4) \quad \sum_{n=0}^{\infty} \frac{a_n n!}{z(z+1) \dots (z+n)}$$

In fact, if in (1) we put $g(z) = 1/\Gamma(z)$ and $c_{n+1} = a_n n!$, $c_0 = 0$ then series (4) results.

In Carmichael's papers, the convergence of series (1) and several properties of the function $\Omega(z)$ defined by the series were discussed. Properties of the factorial series (4) follow as special cases of results obtained by Carmichael for series (1).

Included in Carmichael's papers is a study of the integral

$$(5) \quad \int_0^{\infty} \frac{g(z+t)}{g(z)} \phi(t) dt,$$

where $\phi(t)$ is Riemann integrable over every finite interval $(0, T)$, and $g(z)$ has the asymptotic representation already mentioned. This thesis may also be considered an extension of the study of integral (5).

In two papers published in 1944 and 1946, W.C.G. Fraser extended the factorial series to the factorial transform

$$(6) \quad \int_0^{\infty} B(z, t+1) d\alpha(t)$$

where $B(z, t+1)$ is the well-known beta-function. This integral reduces to the factorial series (4) when $\alpha(t)$ is a properly chosen step-function. Fraser showed that integral (6) has many of the properties possessed by series (4). The integral (2) discussed in this thesis is an extension of series (1) in the same sense that (6) is an extension of (4).

In Chapter II, Section 4, we show that the region of convergence of integral (2) is in general a half-plane

$$\text{Re}(\sigma_s z) < \sigma_c$$

where σ_s is in general complex and is identifiable from the particular form of the asymptotic representation (3) of $g(z)$, and σ_c is a determinate real number. In Section 6, a formula for σ_c is obtained. The proof of the formula depends on some equiconvergence theorems in Section 5, where we show that integral (2) and certain other integrals converge or diverge together.

The region of absolute convergence is determined in Section 7 and is found to be in general a half-plane, $\text{Re}(\sigma_s z) < \sigma_a$. Here σ_a is a number that can be determined. In fact, a formula for σ_a is obtained in Section 8.

In Section 9, it is shown that the integral (2) converges uniformly in every bounded closed region D which lies in the interior of the region of convergence, and hence, the function defined by the integral is analytic in D . Neighborhoods of certain points may have to be excluded from D .

In the last chapter some properties of the function defined by the integral are discussed. In Section 10 it is shown that $f(z)$ has a singularity on the axis of convergence when $k = 0$ and $m = 0$ or 1 and if $c(t)$ is monotonic. An analytic continuation of $f(z)$ is also obtained in Section 11. Here the function $c(t)$ is required to be analytic; hence, the function defined by series (1) is not continued by the theorem obtained.

116 pages. \$1.45. MicA54-3096

ON THE CONTINUITY OF THE SOLID AND THE FLUID STATES

(Publication No. 10,155)

Walter Noll, Ph.D.
Indiana University, 1954

In this dissertation the mathematical theory of a general type of "amphimorphic materials," which includes both solids and fluids, is developed. Generalizing certain ideas of MAXWELL and ZAREMBA, a constitutive equation of the following form is proposed in chapter II:

$$(1) \quad \dot{T} = \mathfrak{F}(Q, T, \rho),$$

where $Q = \nabla x v$ = velocity gradient tensor,
 ρ = density,
 $T = S + pI$ = extra stress,
 S = stress tensor,
 $p = p(\rho)$ = hydrostatic pressure, a given function of ρ ,
 I = unit tensor,
 \dot{T} = material time derivative of T .

In the preliminary chapter I, a general invariance requirement, called the principle of isotropy of space, is postulated. It must be satisfied by any constitutive equation. In addition, a general definition of an isotropic material is given. According to this definition, materials defined by (1) are automatically isotropic. The principle of isotropy of space implies restrictions on the admissible functional forms of \mathfrak{F} in (1). It turns out that (1) must reduce to

$$(2) \quad \dot{T} + TW - WT = \mathfrak{F}(D, T, \rho),$$

where D = rate of deformation = symmetric part of Q ,
 W = vorticity = antisymmetric part of Q ,

and where F is a "hemitropic" function, i.e. it satisfies the functional equation

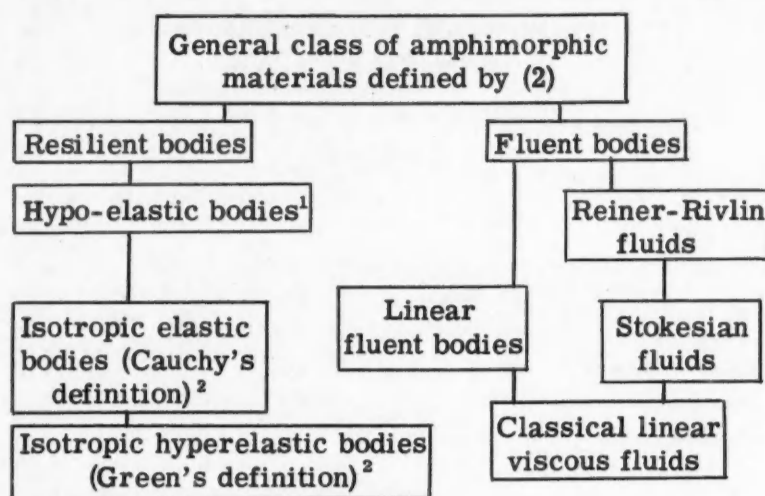
$$R \mathfrak{F}(D, T, \rho) R^{-1} = \mathfrak{F}(RDR^{-1}, RTR^{-1}, \rho),$$

R being an arbitrary rotation (proper orthogonal transformation). Two general types of bodies with a defining equation of the form (2) are distinguished as follows:

- α) Resilient bodies. They can be "at ease" ($v = 0, \dot{T} = 0$) in any stressed state ($\mathfrak{F}(0, T, \rho) = 0$ for all T).
- β) Fluent bodies. They can be at ease only when under the hydrostatic pressure $S = -p(\rho)I$ ($\mathfrak{F}(0, T, \rho) \neq 0$ for $T \neq 0$).

In chapter III various special cases of (2) are considered, and the connection with the theory of elasticity (finite strain) and the general theory of viscous fluids is established. The results are indicated in the following diagram. The restrictions on the constitutive equations for elastic and hyperelastic bodies which result from the principle of isotropy of space and from the general definition of isotropic materials are discussed in some detail.

In chapter IV some exact solutions in special cases are given. Homogeneous stress is discussed for the general class of amphimorphic materials.



For fluent bodies at rest but not at ease there is a phenomenon called pure stress relaxation. Simple shearing flow and Poiseuille flow are investigated in detail for incompressible linear fluent bodies, defined by the constitutive equation

$$\dot{T} + TW - WT = \lambda_1 T + (\mu_1 + \alpha_2 \text{tr} T) D + \alpha_3 (TD + DT) + \{\lambda_2 \text{tr} T + \alpha_1 \text{tr}(DT)\} I.$$

It is interesting that, for one type of such materials, steady flow through a circular pipe is possible only up to a certain critical speed depending on the value of a material time constant. It does not seem impossible that this result is related to the occurrence of turbulence.

The mathematical deductions given are rigorous and no terms are ever neglected. All constitutive equations considered are valid for arbitrary motions. 119 pages. \$1.49. MicA54-3097

1. See C. TRUEDELLE, Hypoelasticity, forthcoming in J. Rational Mech. Anal.

2. See C. TRUEDELLE, The Mechanical Foundations of Elasticity and Fluid Dynamics, J. Rational Mech. Anal., v.1, pp. 125-300 (1952).

ON THE COEFFICIENTS OCCURRING IN THE ASYMPTOTIC EXPANSION OF THE GENERALIZED HYPERGEOMETRIC FUNCTION

(Publication No. 9891)

Thomas David Riney, Ph.D.
Purdue University, 1954

Major Professor: H. K. Hughes

Let the entire function $pG_q(z)$ be defined by the Maclaurin series

$$pG_q(z) = \sum_{n=0}^{\infty} \frac{pG_q(n)}{n!} z^n,$$

where

$$pG_q(n) = \frac{\prod_{k=1}^p \Gamma(n + \sigma_k)}{\prod_{k=1}^q \Gamma(n + \rho_k)}$$

Here σ_k and ρ_k denote arbitrary complex parameters.

The function $pG_q(w)$ is represented in a certain half plane by an integral of the form

$$pG_q(w) = \frac{c \sigma^w}{\Gamma(\alpha_w + b + 1)} \int_0^1 t^{\alpha_w + b} \varphi(t) dt,$$

where $\varphi(t)$ is defined by a certain inversion integral. Using the property that $pG_q(w)$ satisfies the difference equation

$$pG_q(w+1) = \frac{\prod_{k=1}^p (w + \sigma_k)}{\prod_{k=1}^q (w + \rho_k)} pG_q(w),$$

there is determined a linear differential equation $L[y] = 0$ satisfied by $\varphi(t)$. By use of the integral representation of $pG_q(w)$ and the asymptotic expansions of two simple functions, a new derivation is given for the asymptotic expansion of $pG_q(z)$. It turns out that $\varphi(t)$ is regular in the neighborhood of $t = 1$ and its Taylor series expansion about $t = 1$ generates the

constants $\varphi^{(m)}(1)$ appearing in the asymptotic expansion of $pG_q(z)$. A recursion formula of length q is obtained for the constants $\varphi^{(m)}(1)$ by substituting the series into the differential equation $L[y] = 0$.

The constants $\varphi^{(m)}(1)$ are shown to occur as the coefficients in a certain asymptotic factorial expansion of $pG_q(w)$. A different recursion formula for the constants $\varphi^{(m)}(1)$ is obtained by substituting this expansion of $pG_q(w)$ into the difference equation above. Finally, it is shown that the asymptotic factorial expansion of $pG_q(w)$ has a finite abscissa of convergence whenever $q - p \leq 5$.

71 pages. \$1.00. MicA54-3098

ON GALOIS THEORY FOR CERTAIN CLASSES OF NILPOTENT ALGEBRAS

(Publication No. 9892)

Bill VanTrump Ritchie, Ph.D.
Purdue University, 1954

Major Professor: Sam Perlis

The first part of this dissertation extends the Galois theory of fields to arbitrary rings in so far as possible. A subring B of a ring A is called normal if all automorphisms fixing B elementwise fix no larger subring elementwise. A subgroup H of the group G of automorphisms of A is called G -complete if the subring of elements of A fixed by H is fixed by no larger subgroup of G . A one-to-one correspondence between normal subrings and G -complete subgroups is established. If a subring B of A is characteristic, then the subgroup H fixing B elementwise is shown to be a normal subgroup of G , and conversely. If C is a normal subring of A , conditions under which a subring B such that $A \supseteq B \supseteq C$ is normal are investigated.

Next, total nilpotent algebras are investigated from the point of view of Galois theory. In a large class of subalgebras, including all characteristic subalgebras, those which are normal are determined.

Then, maximal nilpotent algebras are investigated. The automorphism group of a maximal nilpotent algebra is explicitly determined. It is proved that the powers of maximal nilpotent algebras and of certain other types of nilpotent algebras are normal subalgebras.

A connection between Galois theory in a ring A and commutativity in a ring of endomorphisms of A is established. The radical of this ring of endomorphisms is investigated for the case where A is a nilpotent algebra.

Finally, homomorphisms of maximal nilpotent algebras are discussed. Based on the fact that every nilpotent algebra A is the homomorphic image of some maximal nilpotent algebra $F_{k,r}$, a relation is established between the automorphism group of A and certain groups of automorphisms of $F_{k,r}$ associated with the kernel I of the homomorphism from $F_{k,r}$ to A .

77 pages. \$1.00. MicA54-3099

DECOMPOSITIONS OF ANALYTIC FUNCTIONS WITH RESPECT TO THE SINGULAR SET

(Publication No. 9130)

Jack Unger Russell, Ph.D.
University of Illinois, 1954

Define a single valued function f of a single variable from the extended plane to be extended analytic with domain of extended analyticity D if f is analytic on D and if there exists no function g , analytic and single valued on a set G properly including D , such that the restriction of g to D is f . The singular set of f will be $C(D)$, the complement of D . Throughout this abstract let f be an extended analytic function with singular set F .

The problem is, given f and given a decomposition of the form $F = \bigcup A_i$, under what conditions can f be expressed as $f = \sum f_i$, $z \notin F$, where f_i is extended analytic with singular set A_i ? This problem was partially solved by N. Aronszajn¹ in two theorems. His first states that if the decomposition of F is into a finite number of arbitrary closed sets, then no further conditions are necessary to assure that f can be decomposed as desired. His second theorem, for the infinite case, states that when the A_i are open in F , and are pairwise disjoint, then f can be expressed as $f = \sum_{i=1}^{\infty} (f_i - g_i)$, $z \notin F$, where f_i is a "generalized principal part" (implying f_i is extended analytic) of f for A_i , and g_i is rational with poles in $L = \{z | z = \text{limit point } z_n, z_n \in A_n, n \rightarrow \infty\}$. Convergence properties are stated.

These theorems are used, along with Walsh's extension of the Runge theorem for rational approximation, to further solve the problem, as indicated in the following two theorems.

Theorem 1. If the decomposition $F = \bigcup_{i=1}^{\infty} A_i$ is given, with no condition on the A_i , then there exists a decomposition of f of the form $f = \sum_{i=1}^{\infty} (f_i - g_i)$, $z \notin F$, where f_i is extended analytic with singular set A_i , g_i is rational with poles in L . The series converges uniformly in $C(F \cup N(L))$, and absolutely in $C(F)$. ($N(L)$ is a neighborhood of L .) Furthermore, if C is any set consisting of exactly one point from each component of L , then the poles of g_i can be chosen to lie in C .

Define $R = \{z | z \in \overline{A_i} \cap \overline{A_j}, i \neq j\}$, $R_0 = R \cup L$, $A_{n,0} = \overline{A_n} - R_0$, and $A_{n,1} = \overline{A_n} \cap R_0$. We can then state:

Theorem 2. With the same hypotheses as in Theorem 1, one has $f = \sum_{i=1}^{\infty} (f_{i,1} - g_i)$, $z \notin F$, where $f_{i,0}$

is a principal part of f for $A_{i,0}$, $f_{i,1}$ is extended analytic with singular set $A_{i,1}$, $f_{i,0} + f_{i,1}$ is extended analytic with singular set A_i , and g_i is rational with poles in L . Convergence is as in Theorem 1.

The set F possesses a countable dense subset, so $F = \bigcup_{n=1}^{\infty} \{z_n\}$. Then theorem 2 implies a decomposition of f into functions each with a single singularity, except for the rational approximating functions. If F has only finitely many components, then f can be written in the form $\sum_{n=1}^{\infty} h_n$, where h_n has singular set the single point z_n . 35 pages. \$1.00. MicA54-3100

1. Acta Mathematica, Vol. 65 (1935), pp. 1-165.

NOTES ON A CLASS OF ERGODIC TRANSFORMATIONS

(Publication No. 9781)

Charles Junior Standish, Ph.D.
Cornell University, 1954

The transformations investigated are defined as follows. Let t ($0 \leq t \leq 1$) be represented in dyadic expansion.

$$t = \frac{\epsilon_1}{2^1} + \frac{\epsilon_2}{2^2} + \dots \quad \epsilon_k = 0 \text{ or } 1$$

Let π be a permutation of the positive integers; then $T_{\pi}(t)$ is defined by

$$T_{\pi}(t) = \frac{\epsilon_{\pi(1)}}{2^1} + \frac{\epsilon_{\pi(2)}}{2^2} + \dots$$

That is, $T_{\pi}(t)$ is a "shuffling" of the digits in the dyadic expansion of t .

Our results are grouped in three sections. In section 1 we prove that $T_{\pi}(t)$ is measure preserving for every permutation π and $T_{\pi}(t)$ is ergodic (metrically transitive) if and only if neither π nor any of its iterates has a fixed point. (A transformation is said to be metrically transitive if the only measurable invariant sets are zero sets and their complements.) In addition it is established that the transformations, if

ergodic, are strongly mixing. A strongly mixing transformation T is one for which

$$\lim_{n \rightarrow \infty} \mu(T^n(A \cap B)) = \mu(A) \mu(B)$$

Part two establishes three main theorems.

Theorem 1: The series $\sum_{k=1}^{\infty} \frac{f(T_{\pi}^k x)}{k}$ either converges almost everywhere on $[0,1]$ or diverges almost everywhere on $[0,1]$. (T_{π}^k denotes the k th iterate of T_{π} .)

verges almost everywhere on $[0,1]$ or diverges almost everywhere on $[0,1]$. (T_{π}^k denotes the k th iterate of T_{π} .)

Theorem 2: The series in theorem 1 converges almost everywhere on $[0,1]$ if $f(x)$ has mean value zero and is expandable in an absolutely convergent Walsh-Fourier series.

Theorem 3: There exists a subsequence $\{n_k\}$ of the positive integers (the sequence depending on the permutation π) such that $\sum c_k f(T^{n_k} x)$ converges almost everywhere provided $\sum c_k^2 \log^2 k < \infty$.

Section three deals with the representability of functions of the form $f(x) = \sum_{k=1}^{\infty} c_k r_k(x)$, $\sum_{k=1}^{\infty} |c_k| < \infty$ ($r_k(x)$ = the k -th Rademacher function) in the form $f(x) = g(x) - g(Tx)$ where $g(x)$ is representable as $g(x) = \sum_{k=1}^{\infty} d_k r_k(x)$ and where T is the transformation associated with the permutation $(\dots 53124\dots)$. The representation is always possible if $c_k = O(\frac{1}{k^\alpha})$, $\alpha > 3/2$, not necessarily possible if $1 \leq \alpha < 3/2$.

33 pages. \$1.00. MicA54-3101

ON IRREGULAR BOREL MEASURES

(Publication No. 10,015)

George Herbert Swift, Jr., Ph.D.
University of Washington, 1954

The class of Borel sets of a topological space X is the σ -algebra \mathcal{B} generated by the compact subsets of X . A Borel measure is any measure μ defined on \mathcal{B} . μ is outer (inner) irregular at a Borel set B if $\mu(B) < \inf\{\mu(U) : B \subset U \text{ where } U \text{ is an open Borel set}\} (> \sup\{\mu(C) : C \subset B \text{ where } C \text{ is compact}\})$.

If $\bigcup_{i=1}^{\infty} A_i$ is a union of Borel sets A_i which are pairwise separable by disjoint open Borel sets, $\mu(\bigcup_{i=1}^{\infty} A_i) < \infty$, and μ is outer (inner) irregular at A_{i_0} for some $i_0 = 1, 2, \dots$, then μ is outer (inner) irregular at $\bigcup_{i=1}^{\infty} A_i$. If μ is n -valued and totally finite, then $\mu = \sum_{i=1}^m \mu_i$ where (1) $0 < m < n$ and (2) each μ_i is a 2-valued Borel measure on X . If μ_i ($i=1,2,\dots$) is a Borel measure on X and $\sum_{i=1}^{\infty} \mu_i < \infty$, then $\mu = \sum_{i=1}^{\infty} \mu_i$ is a Borel measure on X such that μ is outer (inner) irregular at a Borel set B if and only if μ_{i_0} is

outer (inner) irregular at B for some $i_0 = 1, 2, \dots$.

If μ is n -valued, then μ is outer irregular at a Borel set B if and only if there exists a non-void class \mathcal{A} of non-void Borel sets such that (a) $\{A_i\}_{i=1}^{\infty} \subset \mathcal{A}$ implies that $\bigcap_{i=1}^{\infty} A_i \in \mathcal{A}$, (b) $A \in \mathcal{A}$ and $A = B_1 \cup B_2$ where $B_1 \cap B_2 = \emptyset$ and $B_1, B_2 \in \mathcal{B}$ imply that there exists an $A_0 \in \mathcal{A}$ such that $A_0 \subset B_1$, and (c) for every open Borel set $U \supset B$, there exists an $A \in \mathcal{A}$ such that $A \subset U \cap B'$.

Let X be a σ -compact Hausdorff space. If μ is n -valued and irregular, and $\mu(Z) < \infty$ where Z is the set of all points x such that $\mu(\{x\}) > 0$, then μ is outer irregular at $\{x_0\}$ for some point x_0 . μ is outer irregular at a Borel set B if and only if μ is inner irregular at B' . μ is regular at every Borel set if and only if μ is outer regular at every compact set. If μ is n -valued and totally finite, and N is the least positive value assumed by μ on X , then μ can be irregular at most $[\mu(X)/N]$ points of X . If μ is n -valued and totally finite, then μ is irregular if and only if there exists a point x_0 and a non-void class \mathcal{A} of non-void Borel sets such that (1) \mathcal{A} satisfies (a) and (b) (see above), (2) $\{x_0\} \notin \mathcal{A}$, and (3) $A \in \mathcal{A}$ implies that $x_0 \in A$.

Let X be a Hausdorff space. If $\mu(Z) < \infty$ where Z is the set of all points x such that $\mu(\{x\}) > 0$, then there exists a Borel measure ϕ on X such that (1) $\phi(\{x\}) = 0$ for every point x and (2) μ is outer (inner) irregular at a Borel set B if and only if ϕ is outer (inner) irregular at B .

Let X be a normal, non-compact, locally compact Hausdorff space. If $\alpha X = \beta X$ and $\{p\} = \beta X \cap X'$, then there always exists an n -valued, finitely additive measure on the algebra generated by the compact sets of βX which is outer irregular at $\{p\}$; if the class of subsets D of X where (1) D is closed in X and (2) $p \in D'$ is closed under formations of countable intersections, then there exists an n -valued Borel measure on βX which is outer irregular at $\{p\}$.

Let X be a compact Hausdorff space. There exists a totally finite, n -valued, irregular Borel measure on X if and only if there exist a point p and a measure ϕ on the σ -algebra of subsets of $X \cap \{p\}'$ generated by the open sets in $X \cap \{p\}'$ such that (1) X is non- σ -compact and (2) ϕ is zero and regular at every compact subset of $X \cap \{p\}'$.

104 pages. \$1.30. MicA54-3102

REDUCTION OF OPEN MAPPINGS

(Publication No. 9670)

Robert Fones Williams, Ph.D.
University of Virginia, 1954

In 1936, G. T. Whyburn defined an irreducible mapping to be a continuous mapping f , of a compact metric continuum A onto B , such that no proper sub-continuum of A maps onto B under f . Secondly, merely assuming A to be compact and metric, he defined f to be strongly irreducible provided that no closed proper sub-set of A maps onto B . J. Rozanska

independently defined this second type of mapping in 1937, though neither of these early papers studied these concepts *per se*, except that Whyburn pointed out that the Brouwer Reduction Theorem did guarantee that either of these two phenomena could be obtained by perhaps reducing A to a subset, A' . The Brouwer Reduction Theorem does not, however, tell whether something is already irreducible, nor can it always be used to obtain a set maintaining certain properties and irreducible relative to others.

In 1939 Whyburn published a paper specifically about these mappings and proved that the set D , of all points at which f is one-to-one, being dense in A is a necessary and sufficient condition that f be strongly irreducible. Also proved were certain other characterizations and another theorem which is of special interest here, though it fits into a sequence of theorems beginning with a question raised by W. A. Wilson in 1925.

As a setting for these theorems, suppose that f is a continuous open mapping of a compact metric space X onto Y . Wilson's question can be stated in modern terminology as follows: if Y is an arc, can f be monotone and irreducible, though not a homeomorphism? B. Knaster, in 1935, published an example where this is indeed the case. However, in this example, the inverses of points of Y are mixed, some being arcs and others indecomposable continua. So he posed the further question as to whether there exists an example in which all inverses are homeomorphic, and in particular, are all arcs.

The question concerning arcs as inverse sets was answered in the negative by E. E. Moise in 1949 and the more general is answered in the affirmative (as S. E. Dyer has pointed out) by an example that R. D. Anderson has announced in another connection, in which the inverses of points are pseudo-arcs. In the meantime certain gaps between these two results have been filled in by authors who were concerned with slightly different hypotheses on X , Y , and f . In 1939 Whyburn showed that if Y is unrestricted and X is a semi-locally-connected continuum, then f has to be a homeomorphism to be irreducible. M. E. Hamstrom proved in 1953, that in case Y is an arc, the negative answer of Moise still holds if the restriction on the inverse of points is relaxed to allow arbitrary locally connected continua. Then S. E. Dyer and the author independently proved that the answer is still in the negative for arbitrary Y , if the inverses of points are decomposable continua.

Thus, if the inverses of points of Y are fairly well behaved, then X itself must have some such properties, which is the topic of the first section of the present thesis. For example, it is shown that if the inverse of each point of Y is locally connected, then within each open subset of X there is an open set V such that f restricted to \bar{V} is monotone. If in addition Y is locally connected, then the set D_c of all points at which X is locally connected is dense in X . Further an example is given where D_c contains no open subset of X , though as is shown, if X is in the plane, then D_c contains a dense open subset of X .

The second section includes a slightly stronger form of the theorem mentioned above in connection

with S. E. Dyer. An analogous result for light open mappings is given, though as is also shown, some restriction has to be made on Y . The theorem of the last section states that if the inverse of each point of Y is a locally connected continuum, then there exists a closed subset, X' of X , such that 1) f restricted to X' is monotone and 2) f restricted to X' is strongly irreducible and onto Y . In conclusion it is interesting to note that property 1) just mentioned is inducible, though the irreducibility obtained is relative to property 2), and thus is not an obvious consequence of the Brouwer Reduction Theorem.

46 pages. \$1.00. MicA54-3103

TRACE ON FINITE AW*-ALGEBRAS

(Publication No. 9168)

Ti Yen, Ph.D.

University of Illinois, 1954

The main results of this paper are the following:

- (A) An AW*-algebra [2] A of type II_1 admits a trace if
- (P): there is a total set \mathfrak{A} of completely additive positive functionals (c. a. p. f.) on A .
- (B) (A) is still true if (P) is replaced by (P''): there is a c. a. positive linear transformation F of A onto its center such that F leaves the center of A element-wise fixed.
- (C) An AW*-algebra of type II_1 has a trace if, and only if, it is an AW*-subalgebra [3] of a type I AW*-algebra, having the same center.
- (D) A type II_1 AW*-algebra satisfying (P) is an AW*-subalgebra of some W*-algebra.

The proof of (A) and (B) follows closely the method used by Murray and von Neumann [6] (see also [1]), with the positive functionals playing the role of inner product. However, a W*-algebra is characterized not only by the presence of enough c. a. p. f.'s, but also by the completeness under the topology induced by positive functionals, namely (*) every strongly convergent bounded directed system has a limit. It turns out that (*) is characteristic of W*-algebra. Precisely, let $(\varphi_\alpha)_{\alpha \in \mathfrak{A}}$ be a unitarily invariant total set of positive functionals (i.e., given unitary $u \in A$ and $\alpha \in \mathfrak{A}$ there exists $\beta \in \mathfrak{A}$ with $\varphi_\beta(x) = \varphi_\alpha(uxu^*)$ for all $x \in A$). Let \mathfrak{A} -topology be defined by assigning sets of the form $\{x \mid \varphi(x^*x)^{1/2} < \epsilon\}$ as a subbase of the neighborhood of 0. Then (E) a C*-algebra A has a representation as a W*-algebra if it is \mathfrak{A} -complete. Nevertheless, AW*-algebras satisfying (P) do have some completeness property that is enough for the validity of (A). Indeed, it can be shown that (F) a commutative AW*-algebra satisfying (P) is \mathfrak{A} -complete.

Suppose A is an AW*-algebra with a trace T . Let Z be the center of A . Then A and T give rise to an AW*-module [4] H over Z so that A is faithfully represented as operators over H . Moreover, if B is the set of all bounded operators on H , A is an AW*-subalgebra of B .

Return to the hypothesis (P). Since A admits a

trace, it then has sufficiently many numerical traces. Each numerical trace induces in A a structure of prehilbert space. Take the completion and their direct sum. Thus one gets a Hilbert space over which A is faithfully represented. Besides, if B is the strong closure of A , then A is an AW^* -subalgebra of B . In view of (F) every commutative AW^* -subalgebra of A is already strongly closed. However, it is not known that whether A is strongly closed.

The paper is concluded with a generalization of approximately finite algebras (dropping the separability condition of [5]) and an example of type $\Pi_1 AW^*$ -algebra with a given center and a trace.

49 pages. \$1.00. MicA54-3104

BIBLIOGRAPHY

1. Dixmier, J., Les anneaux d'opérateurs de classe fini, Ann. Ec. Norm., 66 (1949), 209-261.
2. Kaplansky, I., Projections in Banach algebras, Ann. of Math., 53 (1951), 235-249.
3. ———, Algebras of type I, Ann. of Math., 56 (1952), 460-472.
4. ———, Modules over operator algebras, Amer. J. Math., 75 (1953), 839-858.
5. ———, Quelques resultats sur les anneaux d'opérateurs, C. R. Acad. Sci. Paris, 231 (1950), 485-486.
6. Murray, F. J. & von Neumann, J., On rings of operators, II., Tran. Amer. Math. Soc., 41 (1937), 208-248.

NON-CLASSICAL ORTHOGONAL POLYNOMIALS

(Publication No. 9723)

John William Young, Ph.D.
University of Florida, 1952

Investigation is made of the conditions under which the class of second order homogeneous linear differential equations possesses orthogonal polynomial solutions. It is shown that the classical orthogonal polynomials, such as those of Legendre, Hermite, and Laguerre, are contained as special cases.

$$(A_1 x^{r+z} + A_2 x^{s+z})y_n'' + (B_1 x^{r+1} + B_2 x^{s+1})y_n' + [L_1(n)x^r + L_2(n)x^s]y_n = 0$$

Particular attention is given to the non-classical orthogonal polynomial solutions obtained when $L_1(n) = K_1 L(n)$, $L_2(n) = K_2 L(n)$. It is found that there are two general types of such solutions, one of order and subdegree linear in n , and having an algebraic weight function and finite interval of orthogonality; the other of order quadratic in n , and of subdegree linear in n , and having a transcendental weight function and semi-infinite interval of orthogonality. With suitable restrictions, derivative definitions and integrated square formulas are obtained for these solutions. Certain other properties of interest in these solutions are also considered.

257 pages. \$3.21. MicA54-3105

MINERALOGY

POLYMORPHISM IN ONE DIMENSION

(Publication No. 9777)

Cecil Jack Schneer, Ph.D.
Cornell University, 1954

The occurrence of polymorphs of the silicon carbide type is explained by a simple statistical mechanical theory. Polymorphism in one dimension is a polymorphism in which structural variations occur in the arrangement of the units in one direction while the arrangement of the units in directions at right angles to the unique direction is unchanged. An admissible set of structures is defined to contain all stackings of rigid hexagonal nets at constant vertical interval, with the points of each net above the centers of triangles of the net below. Each net is distinguished by its immediate environment as either h or c , (hexagonal or cubic), where h and c may be considered as energy states. If V is the difference in potential energy between the states, the ratio of the number of nets or systems h to the number c , is given by $n_h/n_c = \exp. -V/kT$, (the Boltzmann factor). Letting this ratio equal $(1-D)/D$, a distribution

function D is defined equal to the probability that a given layer is in the state c . By discarding the one dimensional approximation, V becomes proportional to D and the phenomenon of polymorphism in one dimension is seen to be cooperational with a critical temperature.

The spread ϕ , of the systems h among the systems c depends on a difference in interaction energy ϵ between layers in the same state as h and h or c and c , and layers in unlike states, as h and c .

The spread will be maximum, minimum, or random, depending on whether ϵ is positive, negative, or negligible, respectively. For ordered polymorphs of the silicon carbide type, ϵ must be positive. By summing the interactions ϵ of a given system with all other systems, the potential energy of an orderly spread is shown to be lower than for a random spread, and the potential energies of the polymorphs are compared. Entropy considerations favor simple values of the distribution, D .

The complete transformation from all c to all h , is second order; a gradual change in the probability distribution is accompanied by a gradual change in entropy over a temperature range culminating in a

critical temperature. The polymorphs represent ordered intermediate values of the distribution.

Zinc sulfide powder was tempered and sublimed at 900° C. and below, and x-ray powder photographs of the products were compared. A chart was constructed of the interplanar spacings of (hkl) vs. axial

ratios from 3 to 18, for the identification of long period polymorphs of the admissible set. Lines of long period spacings were formed and modified by the thermal treatment, qualitatively confirming the theory. 101 pages. \$1.26. MicA54-3106

MUSIC

SYMPHONY NO. I

(Publication No. 9612)

Jacob Frederic Goossen, Ph.D.
University of Minnesota, 1954

Symphony No. 1 is written in a modified form of the 12-tone technique developed and perfected by Arnold Schoenberg. The modifications introduced are such that the original series contains tonal implications designed to impart tonal relationships both between tones of the series, and between chord clusters constructed from the series. By a systematic employment of these relationships, the harmonic structure of the music is made tonal. The principles upon which the tonal relationships of the symphony are based are those propounded in Paul Hindemith's "The Craft of Musical Composition."

The work is in three movements, with the following formal design: Introduction and Scherzo, slow movement, and Rondo-Finale. The form of the Introduction is A-B-A, while that of the Scherzo is A (a-b-a)-B-A (a)-coda. Sonata form is employed in the slow movement, although the recapitulation is considerably abridged. The Finale is a Rondo, which differs from the traditional form in that a development section is introduced in place of the usual final contrasting section. The form of the Finale is A-B-A-C-A-development-A. The final A also functions as coda.

The tonal design of the symphony is: Introduction in G, with no contrasting tonalities; Scherzo in F, with contrasting tonalities of B, A, and E-flat; slow movement in D, with contrasting tonalities of E and C-sharp; and the Finale in G, with contrasting tonalities of D, C, A, and C-sharp.

The symphony employs a somewhat smaller orchestra than usual, although the general plan of the classical orchestra is maintained. The instrumentation is: flute alternating with piccolo, oboe, E-flat clarinet alternating with bass clarinet, alto saxophone, bassoon alternating with contrabassoon, B-flat trumpet, F-horn (with optional second horn doubling for reinforcement), trombone, tympani, percussion (requiring two players), piano, and the usual strings. The minimum number in the string choir must be 12-12-10-8-8.

The length of the symphony is approximately 22 minutes, which is made up of Introduction, one and one-half minutes; Scherzo, seven and one-half

minutes; slow movement, six and one-half minutes; and Finale, six and one-half minutes.

It is hoped that this work will exemplify the possibility of reconciling the 12-tone system with tonality. It is felt that American composition need not necessarily move in the direction of ever greater simplification, and this symphony is intended as an experiment in a new, relatively untried area of serious musical composition.

123 pages. \$1.54. MicA54-3107

AN ANALYSIS OF THE FOLK-MUSIC
IN THE OAXACA AND CHIAPAS AREAS OF MEXICO

(Publication No. 9237)

Cassius Wallace Gould, Ph.D.
Northwestern University, 1954

Outstanding contemporary musicologists interested in Mexican folk music such as Vicente Mendoza, Baltasar Samper, and Henrietta Yurchenco — to name only a few — have been actively engaged for years in collecting indigenous tunes from all parts of Mexico. It is the opinion of many scholars such as these that the only way the facts about the features of pre-Cortesian musical exemplars can ever be known is by the assembling of a huge mass of evidence in the form of contemporary tunes. From these the pre-Conquest as well as post-Conquest features will have to be deduced.

An important purpose of the research project, here summarized, has been to produce new cumulative evidence in the form of hitherto unrecorded and untranscribed tunes that may be found today in the Oaxaca and Chiapas areas of southern Mexico. Prior to the author's field trip few others have explored the indigenous musical potentialities of this particular region.

Of all the themes collected in the area explored, the Lacandon Indian theme given in Chapter V of the author's dissertation has the best chance of being a genuine pre-Cortesian exemplar. Not only is it in the pentatonic mode but it also employs disjunct motion, descending trend, and has an over-all effect of minor modality — features frequently associated with primitive music.

It would be difficult in these few paragraphs to

draw up a well organized brief that would reveal the proportions of primitive or pre-Cortesian features found in the various specimens analyzed. Each exemplar shows certain traits and collectively the exemplars tend to substantiate the assumed facts which have been set forth in Chapters I and II of the dissertation. The pentatonic scale in pure and in altered forms has been found in some of the specimens, but, likewise, so have six and seven-toned scales.

Binary meters have been found frequently, but so also have ternary, compound, and irregular meters. Practically all the instrumental exemplars examined have strong program tendencies. Certain irregularities of pitch were found in several of the tunes. This tendency to deviate from standard frequency ratios, which is a characteristic feature of much exotic music such as that which is found in Polynesia, Micronesia, Oceania, parts of Africa, and even in many part of Japan, might suggest an influence which antedates the infiltration of Spanish culture.

However, this study was not made solely for the purpose of tracing pre-Conquest traits. With regard to the post-Conquest vocal forms which have been analyzed, such as the corridos, sones, huapangos, and canciones, there has been little attempt made to trace pre-Cortesian influences. For the most part, the vocal exemplars have been analyzed for their content—harmonic, melodic, and textual. The Spanish influence in most of these is obvious and the attempt has been made to point out these characteristic Iberian features.

Musicologists and anthropologists will undoubtedly be most interested in the exemplars printed in the dissertation which have features which might be traced to pre-Spanish days. Others may find the contemporary songs more to their liking. But the purpose of the study will have been accomplished if the exemplars transcribed and analyzed for the first time should prove of value to future scholars delving into the lore of the region where these specimens were obtained. 327 pages. \$4.09. MicA54-3108

**A RADIOGRAPHIC, SPECTROGRAPHIC, AND
PHOTOGRAPHIC STUDY OF THE NON-LABIAL
PHYSICAL CHANGES WHICH OCCUR IN THE
TRANSITION FROM MIDDLE TO LOW
AND MIDDLE TO HIGH REGISTERS
DURING TRUMPET PERFORMANCE**

(Publication No. 10,146)

Jody (Joseph) C. Hall, Ph.D.
Indiana University, 1954

There has been much disagreement concerning the method in which the tongue and mouth cavity are employed to aid the lips in playing higher or lower on the trumpet. The purpose of the study was to determine if, in actual performance, different methods of playing are used in different registers, or if there is a common basis of physical adjustment which is used by all players.

The problem was defined and limited to the related questions: (1) what non-labial physical and anatomical changes, if any, occur when trumpet performers make a transition from register to another? (2) if trumpet players differ in the technique employed in each register, what is the relationship between those differences and the resultant tonal quality produced in each register?

A survey of available literature indicated that the great divergence of viewpoints expressed in instructional materials could be attributed to the subjective nature of such statements, or that there are several ways in which to change register. There has been little critical research to substantiate the differing viewpoints.

However, radiological and acoustical techniques have been used in vowel research. These same techniques have been adapted to this study.

Under controlled conditions, radiographs and photographs of nine selected trumpet players were made while the tones they produced were recorded.

For this experiment, an especially constructed sound booth was erected in a constant location. A head positioner was used to permit comparison of radiographs. All subjects played middle B_b, low B_b, and high B_b at predetermined intensities on their own instruments. The same tones were played on a control trumpet. For orientation purposes, each subject spoke aloud the vowels "a" (ah), "u" (oo), and "i" (ee).

Detailed measurements were made of the anatomical positions for each tone and vowel. Comparisons of measurements were made to determine the basic vowel orientation for each subject used when he played middle B_b. Further comparisons were made to discover the changes which were evidenced when the low and high registers were played.

With the aid of a sound spectrograph, the acoustical characteristics of the recorded trumpet tones were analyzed for formant patterns. These patterns were compared with the physiological positions used at the time of their production. By this means, the effect of vowel formation on tonal quality was determined. Additional acoustical comparisons were made of tones in different registers and of the tones produced on different instruments.

The results of this experiment have suggested the following conclusions.

1. Trumpet players tend to assume their own physiological formations, the most common being similar to the vowel "a".
2. The same basic formation tends to be used in all registers.
3. Three different physiological patterns are used in moving from middle to low register, the most common being that of lowering the tongue.
4. No single pattern is used in changing to high register.
5. No particular vowel formation accompanies stretching of the lips.
6. Playing with an "a" vowel formation tends to produce a formant at 1260 c.p.s.
7. Playing with an "u" vowel formation tends to strengthen that formant and lowers it to 1060 c.p.s.
8. If a change is made in tongue position for a

register change, a difference in the formant pattern may result.

9. The physiological formation of the player tends to be more important than differences in instruments.
313 pages. \$3.91. MicA54-3109

THE EVOLUTION OF THE SECONDARY DOMINANT CONCEPT

(Publication No. 10,150)

Robert Carson Lamm, Ph.D.
Indiana University, 1954

This study has been concerned with a presentation of both the history of the evolving theory of the secondary dominant and of the demonstrable validity of this concept when utilized in a contextual analysis of musical practice.

The secondary dominant may be defined as a vertical sonority of tertian structure based on the fifth or seventh scale degrees and functioning as tonic-tendency and tonality-determining harmony. It stands in the same functional relationship to a temporary tonic as does the primary dominant harmony to the principle tonic. This applied dominant thus occupies a secondary position in the tonal complex, being related to the tonic through an intermediary chord. Dominant embellishment chords imply no modulation or protracted change of pitch level and orientation unless confined by subsequent harmonic progressions.

The study has involved a review of theoretical works from Rameau to the present day, with emphasis upon individual contributions as well as the demonstration of discernable trends in the methods of music theory. Also, selections from the literature were presented and analyzed with the intention of both demonstrating the application of the concept and of illustrating the consistency of tonal-formal structure.

The investigation began with the works of Rameau as the first theorist to develop a functional harmonic theory. Rameau's concepts constituted a logical synthesis as compounded of natural data and intellectual organization and, as such, were the precursors of modern contextual analysis.

Theorists following Rameau generally followed the figured bass tradition of individual chord descriptions as combined with a partial realization and application of Rameau's functional theories. There were, however, several theorists who evolved a theory of the secondary dominant as based upon a logical extension of the implications of Rameau's system. These included August Kollmann (1796), J. J. Momigny (1806), Simon Sechter (1853), Carl Piutti and Hugo Riemann (1880's) and very many later theorists until, by the present time, the concept has become generally by most theorists, and especially in Germany and the United States. The English, French, and Italian theorists have been less inclined to utilize the theory.

Applications of the dominant embellishment chord

concept have been demonstrated from the earliest appearances of vertical sonorities involving temporary leading tones resolving to what amounted to temporary tonics (in the 13th century) up to the practice of Rameau. These illustrations of functional analytical procedures were projected within the framework of aesthetic considerations of organic unity and total harmonic-tonal structure.

The ultimate purpose of the study has been a logical presentation of an analytical technique as one element in a process of uncovering the nature of musical organization as reflected in the integration of musical materials with the aesthetic goals and intentions of composers. 261 pages. \$3.26. MicA54-3110

AN ANALYSIS OF THE RELATIONSHIP OF NON-STEPWISE MELODIC MOVEMENT TO TONALITY IN SELECTED WORKS OF W. A. MOZART

(Publication No. 10,151)

George Harold List, Ph.D.
Indiana University, 1954

The inquiry is concerned with the analysis of the relationship of melodic movement to tonality in certain works of W. A. Mozart selected by the process of random sampling from those most frequently performed and recorded. The method of approach is the scrutiny of the music itself and the drawing of conclusions by empirical, descriptive and statistical means.

A descriptive organization of tonal phenomena is developed which integrates both the horizontal and vertical elements of the musical structure. These elements are related to the same constellation of tonal functions by a common means, their identification, whenever possible, with specific roots or with tonal categories composed of these roots.

This tonal organization has as its basis the roots of tertian structures. These roots are determined by rearranging the intervals forming the tertian structures into a succession of thirds in ascending order. The lowest pitch of the association of thirds thus achieved is the "root." No acoustical function is ascribed to the roots determined in this manner. The root represents tonal function, i.e., the relationship exhibited by the particular root to the arbitrarily selected tonal center or tonic of the musical composition. This relationship is established by the frequency and the consistency of the progression of the root to the tonic or to other roots.

The harmonic structures are divided into three categories: the Tonal category containing the tonic and dominant; the Secondary, the subdominant and supertonic; and the Distant, the submediant and mediant. The leading-tone triad and seventh chord are considered dominant structures.

The analysis of melodic phenomena is limited to melodic movements of a third or larger and associations of these intervals moving in the same direction, ascending or descending. Melodic movements are

assigned tonal functions or roots on two bases: the relationship of their component pitches to the harmonic structures and the frequency with which the various roots of these vertical structures are associated with the melodic movements in the musical context. The tonal functions of the melodic movements are categorized as Tonal, Secondary or Distant in the same manner as the vertical structure and are also classified according to three levels of tonal coherence, unambiguous, ambiguous or indefinite. In combination, the classifications and categories present a descending scale of tonal coherence ranging from unambiguous Tonal to indefinite, i.e., representing all six roots or none.

In general melodic movements involved in modulation show ambiguity of tonal function as the modulatory melodic interval has roots in two tonalities. Melodic movements containing non-harmonic tones are in most cases tonally indefinite as the resolution of the non-harmonic tones in this style is almost exclusively stepwise.

The investigation shows that melodic movements having roots in the Tonal category are strikingly preponderant in the Mozart style, forming approximately eighty per cent of all melodic movements found in the music analyzed. The melodic movements having specific tonic or dominant roots, which form approximately seventy-eight per cent of the total of melodic movements, are also found on the highest level of tonal coherence.

Melodic movements with roots outside the Tonal category show less tonal coherence in that they may display different roots in ascending and descending order or upon inversion. Interval patterns composed of these individual intervals frequently show different tonal functions than the component individual intervals. On the other hand, intervals assigned specific tonic or dominant roots exhibit the same roots under all circumstances. Patterns composed of these intervals have the same root as their component intervals.

The tonic-dominant relationship is therefore paramount in the Mozart style, no other root relationship being capable of a clear definition of the tonality.

236 pages. \$2.95. MicA54-3111

THE CONCEPT OF TONALITY IN IMPRESSIONIST MUSIC: BASED ON THE WORKS OF DEBUSSY AND RAVEL

(Publication No. 10,153)

Robert Earl Mueller, Ph.D.
Indiana University, 1954

Though the harmonic innovations of French musical impressionism have been examined by various writers, little material relative to the problems of tonality resulting from these innovations is available. This study is based on an analysis of tonality factors in a representative portion of the music of Claude Debussy and Maurice Ravel which highlights

tonal problems. Tonality defined as tonal organization provides the underlying concept for the analysis. Impressionism, as a term, is accepted in the historical sense as applying to a specific period in music history, with Debussy and Ravel the leading figures. The music selected represents a cross-section of the works of these composers, with emphasis on compositions that embody fragmentary construction.

The first part of the study concerns an evaluation of the limited material available regarding tonal structure in impressionist music. The inadequacy of the usual writing stems from an emphasis on unusual harmonic textures, without considering such sonorities as possible structural pillars in the over-all organization.

In the major portion of the study, basic principles of tonal organization are extracted and summarized from the analysis. It was found that tonal organization centers around fragmentary melodic-harmonic entities whose juxtaposition, reappearance, and variation provide the pattern of the music. These entities, in turn, are based on varying degrees of tonal ambiguity in terms of tertian harmonic theory.

Linkings of major organizing elements to other pillars and to transition passages were examined and the results indicated a high degree of common-tone connection between basic sonorities. Root relations of the third and enharmonic linkings were found to play a major part in the connection of tonal material, providing relationships other than key-centered relationships. Harmonically colored dominant and subdominant relationships were found, but not with equal frequency. Tonal homogeneity, in which the major portion of the harmonic material is derived from consistent use of a minimum number of pitches also characterizes some of the compositions analyzed.

No matter what the harmonic texture, a factor in tonal unity and direction is the framing of beginning and ending portions of the composition by the use of basic sonorities at identical pitch levels. This procedure is seen to have much in common with musical expressions of other periods. Tone centers established within an organizing entity by rhythmic and harmonic weight often emerge as the primary tone centers of the composition. Final sonorities are thus either complete organizing elements, portions or organizing elements, or resolutions (in dominant-to-tonic fashion) of organizing elements.

It was concluded that a high degree of consistency exists in the treatment of the various sonorous organizing forces in the music analyzed. Patterns of juxtaposition of basic melodic-harmonic fragments, of common-tone connections, of framing of beginning and ending, and of the establishment of tone centers emerged as the prime factors in tonal organization. While key feeling, as exemplified by the usual practice of eighteenth and nineteenth century composers, is de-emphasized, positive factors of tonal direction operate in a consistent manner in impressionist music.

171 pages. \$2.14. MicA54-3112

EARLY RENAISSANCE HARMONY

(Publication No. 10,159)

Ernest Lorenz Trumble, Ph.D.
Indiana University, 1954

The present study is an account of the conversion of Fauxbourdon to Falsobordone during the fifteenth century. Conclusions are based on compositions actually bearing the inscription *faulx bourdon* in eight principal pre-1450 music manuscripts and six collections of the later fifteenth century as well as fourteen Spanish, six Italian, and one French collection of the later Falsobordone or Fabordón. In addition, the statements of eleven theorists were examined and are included in the appendix: Tinctoris, Guilielmus monachus, Adam von Fulda, Gafori, an English and Scottish anonymous, Lanfranco, Luscinius, Coclico, Zarlino, and Praetorius.

The study of the music shows that parallelism of the outer (written) voices in sixths was not a well-defined characteristic of the earliest Fauxbourdon, but rather one which developed in the first decade, c. 1430-1440. With increased parallelism came simplification of melody and rhythm as well as a change to duple meter (with hemiola). At the same time, a contratenor bassus formula, similar in principle to the strict Fauxbourdon contratenor altus was devised as an alternate solution of the enigma posed by the canon *faulx bourdon*. The contratenor altus followed the cantus in lower fourths, and the contratenor bassus followed the tenor in alternating lower fifths and thirds. The former gradually dropped out of use, leaving the bassus, tenor and cantus which, with the addition of a new alto near the end of the fifteenth century, continued to evolve into the reciting tone-cadence style now associated with Falsobordone.

The whole is unified by the term *faulx bourdon* in its function as riddle canon which specified a "contratenor in the manner of the false bourdon." A false bourdon, the object of the riddle, is demonstrated to exist in the form of an acoustical phenomenon now called the difference tone, third tone, or Tartini tone. Adding the contratenor to the treble plain chant at the correct interval, a fourth, the chant is reproduced apparently at original pitch by the melodic line of the difference tone. In the special case of the "first" Fauxbourdon, BL 119 *Vos qui secuti*, Dufay, the melody of the difference tone falls exactly into the *bourdon* range as defined by Henri Arnaud around 1440. The Fauxbourdon bassus formula itself is shown to be produced by the difference tone of the consecutive sixths of the written voices, cantus and tenor, while, on the other hand, a type of contratenor *sine* (without) *faulx bourdon* does not produce a recognizable difference tone melody. In keeping with the usual fifteenth century conception of music, the false bourdon reveals a linear conception of the difference tone.

The occurrence of such an acoustical bass moving naturally in large intervals (fourths and fifths) beneath upper voices in small intervals, resembles the visual phenomenon of near objects apparently moving

by larger degrees than distant objects. Pursuing this analogy further, the developments of Renaissance perspective are used to explain the nature of the contemporary harmonic bass.

302 pages. \$3.78. MicA54-3113

THE NASAL RESONANCE FACTOR IN THE SUSTAINED VOWEL TONE IN THE SINGING VOICE

(Publication No. 10,161)

Warren Buchanan Wooldridge, Ph.D.
Indiana University, 1954

The problem was to discover if there was resonance in the nasal cavities of sufficient quantity to reinforce or modify the sustained oral vowel tone in the singing voice.

Methods and Procedures

The following equipment was employed in the course of the research:

1. Concertone and Presto tape recording machines
2. Shur Unidyne microphone
3. Sound treated recording booth
4. Sound spectrograph tone analyzer
5. Stevens "Trusonic" speaker

Analysis of the problem showed the following as variables:

1. Sex
2. Volume
3. Range or Register
4. Variation among vowels
5. Pitch variation
6. Variation on successive vowel emissions
7. Sinus cavity resonance
8. Trained versus untrained voice resonance
9. Nasal occlusion efficiency
10. Vocal adjustment to compensate for occlusions

Delimitations of the Study

1. The experiment was limited to the sustained oral vowel tone of the singing voice.
2. The study was designed to cover the five primary sung vowels of the Italian and English languages.
3. The study was concerned only with the question of whether resonance of the nasal cavities does or does not produce the quality heretofore referred to as nasal resonance.
4. The control over the resonance space was limited to an anterior occlusion of the nasal passages. The isolation of the sinuses was not attempted.
5. The study was limited in tonal analysis to frequencies up to 8,000 c.p.s.

After the singers were selected and the equipment assembled, the experiment was performed with the subject singing a prepared exercise extending into all registers of the voice. The subject sang within a sound treated booth, once with the nasal passages

functioning normally, and once with the nasal passages occluded. The pairs of vowel sounds were then analyzed by means of a sound spectrograph; the various changes were noted and tabulated.

Findings

The results of the study showed that the differences that appeared between spectrograms of an unoccluded tone and those of an occluded tone were no greater and no different in kind than differences that appeared in spectrograms of two unoccluded tones sung by the same subject under the same conditions.

Some verification of the findings was made by means of a listening test in which a jury of listeners tried to determine aurally which of the two tones of each pair of vowel sounds was the occluded one. Frequency range of the equipment was 15,000 c.p.s.

The results of this phase of the study tended to confirm the previous findings.

Conclusions

Within the limits of reliability of this study, the following conditions seem to obtain:

1. The term "nasal resonance" is without validity in describing voice quality in the singing voice.
2. The nasal cavities do not influence or effect the sustained oral vowel tone in the singing voice to any perceptible degree under 15,000 c.p.s. Any frequencies over this cannot be important.
3. Variations in quality exist even in the same voice on successive emissions of the same vowel. This observation made with singers tends to agree with previous research in the field of Speech.

58 pages. \$1.00. MicA54-3114

PHARMACOLOGY

PHARMACOLOGY AND TOXICOLOGY OF SOME THIURAM DISULFIDES AND RELATED COMPOUNDS

(Publication No. 9538)

Byron A. Barnes, Ph.D.
University of Florida, 1954

With the advent of a drug known as disulfiram (tetraethylthiuram disulfide), the problems involved in the treatment of chronic alcoholism have been considerably lessened.

Even though the desirable effects produced with disulfiram outweigh its toxic side effects, there has been some alarm concerning the more serious consequences which may occur.

It was therefore the purpose of this investigation to evaluate some derivatives of, and compounds closely related to, disulfiram in the hopes that they might possess the same desirable qualities of disulfiram while omitting the undesirable side effects.

The compounds were evaluated on the basis of the LD_{50} and the ability to cause an abnormal increase in blood acetaldehyde after the consumption of alcohol. The largest percentage of deaths in mice used to determine the LD_{50} dosage occurred during the first twelve hours following administration of the drug. Toxic manifestations when observed were characterized by lacrimation, salivation, depressed respiration and toxic convulsions. Death when it occurred was due to respiratory paralysis.

On the basis of this work the following relations of chemical structure to disulfiram effect and toxicity are enumerated:

1. The sulfides tested produced a larger disulfiram effect than did their disulfide analogs. No difference in the toxicity of these compounds was discernible.

2. Increasing the length of the terminal chains of

the symmetrical thiuram sulfides and disulfides caused a progressive decrease in activity and toxicity.

3. In the symmetrical thiuram sulfides and disulfides replacement of a piperidine with a pyrrolidine resulted in increased activity.

4. Substitution on the beta carbon gives more activity than substitution on the alpha carbon.

5. Increasing the number of carbons in this substitution causes decreased activity and toxicity.

6. Unsymmetrical thiuram sulfides and disulfides give an intermediate effect and toxicity to those of their symmetrical homologs.

7. Replacement of piperidine with morpholine on the basic structure results in decreased activity with little or no effect on toxicity.

8. Substitution of diethylamine with piperidine results in only slight decrease in activity concurrent with a correspondingly large decrease in toxicity.

9. Replacing dimethylamine with dicyclohexylamine shows no difference in activity but a decrease in toxicity.

The presence of two amino groups on the basic nucleus seems essential for action as does the presence of double-bonded sulfur groups. The S-S linkage in the compounds tested does not serve as the inhibiting part of the molecule. The best explanation for the thiuram effectiveness in inhibiting acetaldehyde metabolism seems to be that the group $>C=S$ is linked to the enzyme molecule in competition with the substrate, but that to have a sufficiently high affinity for the enzyme a substituted amino group must be present in the molecule.

Disulfiram, tetra-n-butylthiuram sulfide, and tetraisobutylthiuram disulfide when previously administered to rats caused a prolongation of thiopental anesthesia while diethyldicyclohexylthiuram sulfide decreased thiopental anesthesia time.

Acetaldehyde could not be demonstrated as a

component of normal metabolism. Ascorbic acid showed no effect on alcohol metabolism nor did it affect the ability of disulfiram to inhibit the metabolism of acetaldehyde.

Three compounds show excellent possibilities for the treatment of chronic alcoholism and are proposed for further study. These compounds are diethyldicyclohexylthiuram sulfide, tetra-n-butylthiuram sulfide, and tetraisobutylthiuram disulfide.

78 pages. \$1.00. MicA54-3115

ENZYMATIC BASIS OF THE ACTION OF CONVULSANT HYDRAZIDES

(Publication No. 9603)

Keith Fenton Killam, Ph.D.

University of Illinois,

Chicago Professional Colleges, 1954

Supervisor: Keith Fenton Killam

The spectrum of enzymatic inhibition in vitro and in vivo has been characterized for four convulsant hydrazides; semicarbazide, thiosemicarbazide, fur-oyl hydrazide (BL-991) and isoniazid (isonicotinic acid hydrazide). In vitro the compounds inhibited brain L-glutamic acid decarboxylase; the inhibition was competitively reversed by pyridoxal phosphate. Brain glutamic-aspartic acid transaminase and liver L-cysteine desulfhydrase was also inhibited in vitro by semicarbazide and thiosemicarbazide. There appeared to be no difference in the in vitro potency of the four agents despite the marked difference in potency in vivo of the four compounds as convulsant agents. Other convulsant agents, pentylenetetrazol (Metrazol), strychnine and 1, 3-dimethylbutyl-ethyl barbituric acid (a convulsant barbiturate), did not inhibit the L-glutamic acid decarboxylase system in vitro.

The administration of equipotent convulsant doses of semicarbazide and thiosemicarbazide to rats and the determination of enzyme activity at the occurrence of maximal seizures indicated that seizure activity was associated with inhibition primarily of brain L-glutamic acid decarboxylase and not of brain glutamic-aspartic acid transaminase or of liver L-cysteine desulfhydrase.

Neither the convulsant hydrazides or the better known convulsant agents inhibited the enzymes associated with the synthesis of pyridoxal phosphate.

Further evidence for the relationship of enzyme inhibition and seizure activity was afforded by the semi-quantitative determination of free-amino acid levels in alcoholic extracts of brains from rats convulsed with semicarbazide as compared with controls and with rats convulsed with pentylenetetrazol. In the semicarbazide treated rats the levels of gamma-aminobutyric acid were found to be markedly decreased and the levels of alanine and glutamine slightly increased over the control rats. The pentylenetetrazol treated animals exhibited no change in free-amino acid concentrations in the brain.

Using combined neurophysiological and enzymatic techniques, it was found in the cat that electrical changes in the central nervous system paralleled L-glutamic acid decarboxylase inhibition. It was further demonstrated that, with the proper technique and selected endpoint, enzyme inhibition preceded changes in electrical activity. A sensitivity of diencephalic areas to the action of thiosemicarbazide was also demonstrated both neurophysiologically and enzymatically.

An anatomical distribution of L-glutamic acid decarboxylase, glutamic-aspartic acid transaminase, and functional pyridoxal phosphate was determined in selected areas of cat brain. The areas most sensitive to the action of the hydrazides were found to have a higher concentration of the apoenzyme of L-glutamic acid decarboxylase and less of the total apoenzyme was saturated with coenzyme.

The significance of the action of the hydrazides on amino acid metabolism in the central nervous system was discussed in relation to the convulsant properties of these drugs. 79 pages. \$1.00. MicA54-3116

A PHARMACOLOGICAL INVESTIGATION OF AVOCADO (*Persea americana* MILL.) OIL

(Publication No. 9556)

Sarah Ruth Norred, Ph.D.

University of Florida, 1954

Within the last three decades, there has been a continual increase in the use of avocado oil in the manufacture of cosmetics and soaps. Although there are claims in the literature that substances dissolved in avocado oil are readily absorbed, there is little data to substantiate these claims.

The oil is reported to be rich in sterols, but no record of its lack of hormonal action is available. The fruit is believed by certain people to possess lactogenic action but experimental evidence for this action could not be traced in the literature.

A light greenish-yellow oil having a slight characteristic odor and a bland taste was extracted with ethyl ether from the dried pulp of Florida-grown avocados.

Aliquots of the oil were sterilized by dry heat, irradiated by ultra-violet light, and chilled to remove stearins. A commercial grade of California avocado oil was also tested and sesame oil was selected as the control for certain of these experiments.

The crystalline material obtained from the unsaponifiable fraction of avocado oil was devoid of estrogenic activity.

No estrogenic, androgenic, adrenalcortical, or lactogenic action could be detected in the oil.

The avocado oil was more irritant than sesame oil but not sufficient to prohibit its parenteral use.

In moderate and massive doses, it was non-toxic and no pathological changes could be detected by gross examination of organs or microscopic examination of tissues.

As topical vehicles, there was no apparent difference between avocado and sesame oils.

It appeared that avocado oil, after parenteral administration, was less rapidly absorbed than sesame oil. However, it was not absorbed slowly enough to be applicable as a vehicle for repository injection.

Drugs dissolved in avocado oil, administered either topically or parenterally, produce systemic actions.

Although the chemical constants of avocado oils frequently fall outside the ranges suitable for injectable vehicles, it would be possible to process an avocado oil having constants falling within the desired ranges. The chemical constants of the oil extracted in this investigation did not fall within the ranges suitable for parenteral injection. This oil showed a lower iodine value and a higher saponification value than those reported by other investigators.

Avocado oil offers no particular advantage over sesame oil as an injection vehicle.

62 pages. \$1.00. MicA54-3117

A STUDY OF THE ADAPTABILITY OF ISOPROPYL MYRISTATE FOR USE AS A VEHICLE FOR PARENTERAL INJECTIONS

(Publication No. 9557)

Edward Louis Platcow, Ph.D.
University of Florida, 1954

Due to the reporting by others of the low oral and toxicities of isopropyl myristate and the similarity in some of its physical properties with the vegetable oils now being used as repository vehicles, a study was undertaken to ascertain the adaptability of this compound for use as such a vehicle.

The compound was shown to be non-toxic, non-allergenic, and to have a low degree of irritancy when applied parenterally or to mucous membranes in rats, guinea pigs, and rabbits.

Histological studies showed no pathology to the following organs removed from rats exposed to the vehicle for twenty days by repeated intraperitoneal injections: liver, kidney, heart, intestine, spleen, gonads and adrenal glands. Sections of injected striated muscle tissue (gluteal muscles) revealed no pathology after single injections, but on repeated injections, local irritation and necrosis occurred which was due primarily to repeated wounding at the site of injection.

Penicillin blood level determinations as conducted in rabbits by intramuscular injections were initially high after a period of an hour with crystalline sodium G and procaine penicillin preparations in the vehicle with 2 per cent aluminum monostearate added as a suspending agent. The blood levels of the former remained above the effective therapeutic blood level for eight hours while those of the latter remained above the therapeutic level for forty-eight hours. A mixture of crystalline penicillin G sodium in a base of 10 per cent beeswax and isopropyl myristate showed initially much lower blood levels than the two preparations mentioned above, and the blood levels remained in effective therapeutic concentrations for a period of twelve hours. This mixture induced a rather high degree of irritation, tissue necrosis and fibroblastosis as exhibited in microscopic sections of tissues taken fourteen days after administration.

Alpha-estradiol dissolved in this vehicle induced estrus in ovariectomized rats after a period of three days. This compared favorably with controls run at the same time, utilizing alpha-estradiol in sesame oil, a commonly employed repository vehicle.

58 pages. \$1.00. MicA54-3118

PHILOSOPHY

TELEOLOGY AND THE ACTIVITY OF NATURAL SYSTEMS

(Publication No. 10,166)

Harold Joseph Allen, Ph.D.
Columbia University, 1954

This dissertation is directly concerned with answering two questions:

(1) In what ways do men, animals, machines and inanimate objects, when regarded as state-determined systems (that is, "natural systems") exhibit purposiveness in their activity?

(2) In which of these ways is purposiveness manifested in each instance?

Answers to these questions have important implications for such problems as the relation of teleological

explanation to mechanical explanation and scientific method, and the place of man in nature.

Teleology is here intended in a behavioristic sense; no reference is made to subjective mental states. The causation and control of purposive activity as well as its relation to both the environment in which it occurs and its goal are examined in detail. Such activity, though it may be conscious, intelligent or rational, need have none of these characteristics. A kind of perception, expectation and judgment are also involved. Mechanical causation (in the sense of obedience to the laws of chemistry and physics) is always presupposed, and teleological causation is to be regarded as a particular kind of mechanical causation.

The essential mark of all purposive activity is directive correlation. Central to directive correlation is the idea of a pairing of response to

circumstance so as to bring about successful achievement of a goal. That directive correlation implicates success does not imply that activity need be successful to be purposive. While directive correlation constitutes the only evidence for purpose, activity caused and controlled by a purposive agent may be teleological without giving rise to directive correlation in every instance.

Characteristic features of the behavior of men and animals are marked by varying kinds and combinations of directive correlations. The organic functions of maintenance, development and reproduction are characterized by patterns of directive correlation, and approach the purposive level of instinct. Mechanical devices such as the thermostat and Watt's governor show a degree of purposiveness corresponding to that of reflex or tropism. Finally, all state-determined systems are teleological at least with respect to a goal analogous to maximum entropy or minimum potential energy. Any state-determined system may also be purposive with respect to other goals insofar as it manifests purposive causation, control and adaptation with respect to the attainment of such goals.

Two important assumptions are implicated in the conclusions reached. First, teleology as here understood has meaning only with respect to state-determined systems. Secondly, sensible questions about the purposiveness of state-determined systems must always relate to some specific goal, since the activity of all such systems is teleological in some sense.

225 pages. \$2.81. MicA54-3119

SANTAYANA: A LIBERAL AND SCEPTICAL MATERIALIST

(Publication No. 10,171)

Francis Howells Coffin, Ph.D.
Columbia University, 1954

While Santayana's materialism may provide an adequate philosophical interpretation of the universe of matter, energy, and light; of planets, stars, and galaxies; of life, history, language, art, and religion; it is less able to satisfy the aspirations of the human spirit. There is also an agnosticism in his thought which questions the very existence of the physical universe; a romanticism which interprets history as a progressive movement toward a liberal and intelligent society; a mysticism which finds satisfaction in the vision of eternal essences. These varied strains tend at once to broaden his thought and to detract from its consistency.

This work is a study of the different tendencies of Santayana's philosophy and of the historical influences that have affected his thought. The first chapter contrasts his materialism, which has its roots in the naturalism of ancient Greece, with his agnosticism, which reflects the epistemological scepticism of the German idealists.

The second chapter concerns Santayana's

treatment of the causal basis of life and history. While he has a keen sense of the development of various cultures and civilizations and sees a progressive movement in history as a whole, he nevertheless assumes that the underlying causes of cultural phenomena are mechanical. The third chapter concerns Santayana's theory of mind. He asserts the existence of consciousness, but is sceptical of the existence of any unconscious mental background such as that involved in the British psychology of association or in the theory of the subconscious mind. The fourth chapter concerns the intellectual structure of experience. Consciousness, being dependent on the life of the organism, also expresses the interests of this life. As a result it takes on meaning and becomes cognitive.

The fifth and sixth chapters concern Santayana's theory of perception and knowledge. It is a consequence of his materialism that perception is not an immediate vision of objects but rather a form of knowledge which logically involves inference. All knowledge is thus symbolical. Santayana goes further and regards all beliefs as human attempts to understand an unknowable real. From a transcendental point of view he arrives at a complete solipsism. The whole physical and mental world becomes an object of faith and even tends to become an illusion as is the world of the orthodox Vedantist.

The concluding chapter concerns Santayana's philosophy of religion. While Santayana's materialism excludes the metaphysical claims of traditional religion, he regards the progressive development of religious belief as a valid phase of cultural activity. He is concerned to separate religious beliefs from beliefs about nature; and he holds that the mixture of these two forms of belief leads to superstition and to a materialistic religion.

Within the religious experience Santayana distinguishes piety from spirituality. Piety is respect for power. Spirituality is a form of religion which looks away from the causal relations which affect life. The spirituality of Santayana's early writings is a poetic aspiration toward the ideal. This youthful religion turns from the real to the good. The spirituality of his later writings is a dispassionate vision of the eternal essences. There is thus a shift from myth and poetry to metaphysics.

196 pages. \$2.45. MicA54-3120

COLERIDGE'S COMMENTARY ON SWEDENBORG

(Publication No. 9175)

Leonard Martin Edmisten, Ph.D.
University of Missouri, 1954

Criticisms of Emanuel Swedenborg (1688-1772) have almost invariably been extravagant. Depending on the point of view, they have been either black or white, and hardly without exception have concerned only one aspect of the man and his works. This extravagance has been the result of many factors:

insufficient knowledge of Swedenborg's life; the fact that Swedenborg wrote on such a wide variety of subjects; his writing, for the most part, in Latin; the number and length of his works, making it a labor of years to know the whole Swedenborg canon; falsehoods concerning his life repeated by eminent men; and the fact that a new church grew out of his religious writings.

Samuel Taylor Coleridge, however, a man well acquainted with Swedenborg's works and familiar with both pro- and anti-Swedenborg sentiments, is a noteworthy exception to the majority of Swedenborgian critics. Coleridge's critical commentary is supplied in marginal notes to a number of Swedenborg's works and writings critical of Swedenborg. It also appears in personal letters.

Swedenborg's life and works are presented in three phases: as student, scientist, and seer. This bishop's son was well educated and a perennial traveler. During his student days he visited England to further his scientific knowledge. Also, at this time he was something of a poet.

In his scientific period his most important works were *Principia*, 1734, in which he foreshadowed the nebular theory of Kant and La Place; *The Animal Kingdom*; and *The Economy of the Animal Kingdom*.

The period of seership began about 1745, and the change from scientist to seer is illustrated by his *Worship and Love of God*, a work immediately succeeding a mystical experience. From this time forward, Swedenborg believed himself to be in contact with spirits and angels, both in his sleeping and waking state.

The remainder of his life was devoted to travel and the writing of religious works, chief among which were *Arcana Coelestia*, *Heaven and Hell*, and *The True Christian Religion*.

Just before he died, in 1772, Swedenborg communicated with John Wesley, sending him a copy of *The True Christian Religion* and expressing a desire to converse with him, but Wesley was busy at the time and did not see Swedenborg.

Soon after his death, societies for the translation and distribution of Swedenborg's religious works sprang up in England, out of which developed The Church of the New Jerusalem. The two men most instrumental in the development of The New Church were the Reverend John Clowes, in Manchester, and Robert Hindmarsh, in London.

Samuel Taylor Coleridge came to London to Christ's Hospital, located at the very center of Swedenborgian activity, and remained there nine years at the time when The New Church was developing in England. Thus he had every opportunity to know of the movement when he was but a youth. It has been stated that Coleridge annotated Swedenborg's *Prodromus* during his student days, but there is no proof of this statement.

Later in life, Coleridge was personally acquainted with some eminent Swedenborgians to whom he wrote many letters, some of which discuss his interest in and opinion of Swedenborg. Among these Swedenborgians were C. A. Tulk and the sculptor, John Flaxman.

Coleridge, however, seems to have been reluctant to admit publicly his interest in Swedenborg, one reason probably being that such men as Kant, Wesley, Southey, and De Quincey published harsh criticisms of Swedenborg.

Coleridge annotated copies of Swedenborg's *Prodromus*, *The Worship and Love of God*, *The White Horse*, *The Animal Kingdom*, *The Economy of the Animal Kingdom*, *Heaven and Hell*, *The Intercourse between the Soul and the Body*, *The Divine Love and Wisdom*, *The Divine Providence* (unverified), and *The True Christian Religion*. All of these annotations are given in this dissertation save for *The Animal Kingdom* and *The Intercourse between the Soul and the Body*, which evidently have been lost.

Although some of Coleridge's comments on Swedenborg are unfavorable, for the most part they reflect Coleridge's admiration for Swedenborg's concepts and doctrines. They are important in furnishing an objective view of Swedenborg, coming as they do from a great poet and scholar who was well acquainted with Swedenborg's works and with Swedenborgian criticism. In addition, these marginal notes throw some interesting sidelights on Coleridge.

325 pages. \$4.06. MicA54-3121

CARL PHILIPP MORITZ: A STUDY OF HIS ETHICAL AND AESTHETIC CONCEPTS

(Publication No. 9745)

Eva Johanna Engel, Ph.D.
Cornell University, 1954

Moritz' contributions to eighteenth century thought consist in his attempting an objective approach to the great dichotomy between feeling and reason, and in setting up an eudaemonistic ideal in his conception of the artist.

An analytical evaluation of biographical data reveals the constant effort in Moritz of reconciling antithetical values in ethical and aesthetical matters. He attempted to resolve some of these conflicting views through self-analytical reflection. He pursued a deliberate course of mental discipline and engaged in extensive reading of the philosophical writings of Spinoza, Wolff, Gottsched, Pope, Voltaire, and particularly, of Mendelssohn. Through the study of their works, Moritz must have become familiar with the philosophy of Leibniz and Shaftesbury, and with the tradition of neo-platonism.

Mendelssohn had suggested that perception (*Empfindung*) might serve as conciliatory link between the extremes of reason and willpower. Moritz, in turn, sought to prove that willpower depended on reason and must therefore be considered part of it. He superseded Mendelssohn's triad by the three correlated energies *Einbildungskraft*, *Denkkraft*, and *Tatkraft*. These three concepts he applied to ethics and aesthetics.

Denkkraft as demonstrated in the field of ethics represents for Moritz the "arcanum of human

achievement," and the ability to transmit thought. This lends the specific character to the human being. It provides at the same time a continuity which serves Moritz as an argument for palingenesis, or specifically, metempsychosis. The highest perfection that can be expected in this *Weltbild* is harmony; this is represented by the quality of wisdom in ethics, and of beauty in aesthetics. Thus Moritz established a direct relationship between *Denkkraft* in ethics and perception in aesthetics.

Moritz demonstrates an harmonious interdependence between artist, work of art and the ideal of the beautiful. We are shown that nature and art approach identity, inasmuch as art through our perfection becomes beautiful nature. The artist is impelled by what Moritz calls *Darstellungstrieb*, his mind serves as mirror of nature, and through his capacity as *bildender Genius* his own inner perfection is reflected in that part of nature which he has "isolated" in order to make it into a work of art. His aim is thus not directed towards giving pleasure but towards achieving perfection in his work. In this search for

perfection the circle of existence is completed: we achieve perfection within ourselves.

A persistent parallelism is maintained between ethics and aesthetics. Perception is no longer regarded as a restricted exercise of the mind but becomes an important function of the senses. The criterion of harmony is eventually identified with that of beauty. It is ultimately Moritz' aim to achieve a synthesis of emotion and intellect through aesthetic perfection. This ideal is attained in what he calls the state of "objective completeness."

Contents:

Introduction. I. An Analysis of Disproportions. II. Background to Moritz' Philosophical Thought. III. "Philosophie und Schwärmerei." IV. Ethical Concepts. V. Aesthetical Concepts. VI. Evaluation of Moritz' Influence. Bibliography.

174 pages. \$2.18. MicA54-3122

PHYSICS

PHYSICS, GENERAL

SELF-DIFFUSION IN SODIUM AND POTASSIUM CHLORIDE

(Publication No. 9030)

Joseph Felix Aschner, Ph.D.
University of Illinois, 1954

The self diffusion coefficient D of the cation in sodium chloride and potassium chloride has been measured by means of a radioactive tracer technique. In addition, the electrical conductivity σ has been measured using an A. C. bridge method. The diffusion coefficient and the conductivity were then compared by means of the Einstein relation

$$\frac{\sigma}{D} = \frac{ne^2}{kT}$$

where n is the number of charge carriers per cc, e the unit of charge, k the Boltzmann constant, and T the absolute temperature.

In the case of sodium chloride four samples were prepared by the Kyropoulos method, each sample containing a small amount of deliberately added cadmium chloride. The molar ratios $\frac{Cd}{Na}$ were 3×10^{-4} , 14×10^{-5} , 4×10^{-5} , and 5×10^{-6} respectively. It was found that for the two highest concentrations of cadmium there was a deviation from the Einstein relation well outside the range of experimental error. This is explained on the basis of the formation of positive ion vacancy - divalent ion complexes. Such complexes, being neutral, contribute to the diffusion but not to the conductivity, thus invalidating the

Einstein relation. For the two lower concentrations of cadmium the Einstein relation was satisfied within the limit of error.

For each concentration, the expected deviation has also been computed theoretically. This was done by calculating the degree of association, which is defined as the ratio of complexes to impurity ions. The degree of association in turn is derived from the mass action law in two slightly different ways, the difference consisting mainly of the fact that one neglects the interactions between the unassociated charges while the other does not.

Due to the large experimental errors involved in measuring the diffusion coefficients it was not possible to determine which of the two approaches to compute the degree of association results in a better fit of the experimental results. However, qualitative agreement between theory and experiment can readily be discerned. Thus the present experiment is believed to furnish proof that the theory of association as it applies to the system $NaCl + CdCl_2$ is basically correct.

For the two lowest concentrations of cadmium, the predicted degree of association was too small to result in a measurable deviation from the Einstein relation. It is shown, however, that even the very small amount of cadmium present in the crystal with the lowest $\frac{Cd}{Na}$ ratio is sufficient to completely mask the large deviation from the Einstein relation occurring in "pure" sodium chloride crystals. This latter behavior is attributed to one or more types of highly associated impurity ions present even in "pure" crystals. The identity of these ions is not known at present.

In the case of potassium chloride only "pure" crystals, obtained from the Harshaw Chemical Company, were used. Diffusion experiments were carried out only in the intrinsic temperature range, between 500°C and 700°C. It was found that the Einstein relation is satisfied in this range. It can therefore be stated that positive ion vacancy — negative ion vacancy pairs do not contribute appreciably to the diffusion. Were such a contribution to take place, the pairs, due to their neutrality, would not contribute to the conductivity, thus invalidating the Einstein relation. Previous experimental work of a similar nature in which the Einstein relation actually does not seem to be satisfied is believed to be in error.

94 pages. \$1.18. MicA54-3123

A STUDY OF THE INTERNAL FRICTION OF ZINC AND ALUMINUM SINGLE CRYSTALS IN THE 1 TO 5 KC. FREQUENCY RANGE*

(Publication No. 9733)

Hamilton Barhydt, Ph.D.
Cornell University, 1954

The internal friction and Young's Modulus of zinc and aluminum single crystals were measured at room temperature in the strain amplitude range from 10^{-8} to 10^{-5} and in the frequency range from 1 to 5 kc. under conditions of a uniform stress distribution and negligible thermoelastic losses. Single crystals were vibrated in a longitudinal mode with large weights attached to both ends in order to obtain a constant stress distribution over the entire specimen. By changing the size of the weights the frequency of vibration could be changed without causing a change of the stress distribution.

The internal friction was determined by measuring the logarithmic decrement of the free vibration of this system. The vibrations were observed by using the variation of capacity between an electrode and the vibrating system to frequency modulate a radio frequency oscillator. The vibrations were excited electrostatically using the same electrode.

The equations of motion applicable to this vibrating system are derived, making some simplifying assumptions, and the elastic losses due to thermoelastic effects and the influence of the supports were calculated.

The internal friction was found to be independent of amplitude at low strain amplitudes and to increase with amplitude at higher strain amplitudes with the transition between these two types of behavior occurring at strain amplitudes between 10^{-8} and 10^{-6} . The lowest value of internal friction measured was 3×10^{-4} . A certain amount of cold work of the crystals was unavoidable with this method even though the crystals were carefully annealed before each run; thus the measurements were always characteristic of a certain minimum level of cold working.

The same specimens were measured at various frequencies within the range from 1 to 5 kc. with the

same stress distribution at all frequencies. It was found that the internal friction is approximately inversely proportional to the frequency of vibration at low strain amplitudes where the internal friction is independent of amplitude. At higher strain amplitudes where the internal friction is a function of the amplitude the results were inconclusive as far as frequency dependence is concerned because of the great sensitivity to cold work at these higher strain amplitudes.

Some measurements were made on the same specimen for both longitudinal and transverse vibrations at the same frequencies. The results were of the same order of magnitude, and the differences observed could be due to the very different stress distributions.

A theory is proposed attributing the internal friction to two different mechanisms, a rate process at low strain amplitudes where the internal friction is independent of strain amplitude and a static hysteresis process at higher strain amplitudes where the internal friction depends on the strain amplitude.

122 pages. \$1.53. MicA54-3124

*This work was carried out under the sponsorship of the U.S. Office of Naval Research and the U.S. Air Research and Development Command.

A COMPARATIVE STUDY OF METHODS CALCULATION OF ENERGY BANDS IN CRYSTALS; EXTENSIONS OF VARIATION AND ITERATION TECHNIQUES

(Publication No. 9735)

Edmond Brown, Ph.D.
Cornell University, 1954

A primary objective of the band approximation for solids is the calculation of electronic energy eigenvalues, as a function of the wave vector k , for the valence and conduction bands. It has been found possible to incorporate some of the better features of several approaches to this problem in a single method. The usual approximations are made which lead to the one electron Schroedinger equation in a periodic potential.

In applying the method one replaces the Schroedinger equation by an equivalent variation principle. One approximates the solution of the variation problem by expanding it in a finite number of plane waves plus an auxiliary function. This latter function is derived from an available atomic orbital or the result of a single cellular calculation (e.g. Wigner-Seitz¹) by orthogonalization to the plane waves under consideration.

The variation principle leads to a simple matrix equation for the coefficients. The matrix elements include the wave vector as an algebraic parameter so that it is possible to map out the energy structure of the band without the additional labor of recalculating matrix elements.

Arguments are given to show that the choice of functions used with the variation principle is capable of yielding accurate results, comparing favorably with the Orthogonalized Plane Wave method.²

In cases where the required accuracy demands a large number of plane waves in the expansion, the matrix may become too large to be handled by the usual secular equation. A matrix of iteration procedure is presented which simplifies this case. The iteration procedure is capable of converging to excited states in a potential provided an approximate energy eigenvalue is known. The iteration scheme is tested on a one-dimensional Mathieu equation (Schroedinger equation with cosine potential). The rate of convergence (to the second excited state) is quite satisfactory. 72 pages. \$1.00. MicA54-3125

1. E. Wigner and F. Seitz, Phys. Rev. 43, 804 (1933)

2. C. Herring, Phys. Rev. 57, 1169 (1940).

SMALL ANGLE X-RAY SCATTERING BY THE LOW CARBON PARAFFINS

(Publication No. 7583)

John William Buttrey, Jr., Ph.D.
University of Missouri, 1954

The small angle scattering of x-rays from the low carbon paraffins has been investigated experimentally with a single crystal spectrometer, using a rock salt crystal for monochromatization and a geiger counter for detection of the scattered radiation.

It can be shown that if statistical fluctuations in density are accepted as the cause of the abnormally high scattering of x-rays by fluids near the critical point, a relation may be written showing the dependence of the small angle scattering intensity upon the isothermal compressibility — the well-known relation of Zernicke and Prins.

Diffraction patterns from the low carbon paraffins, methane, ethane, propane, and butane, are presented for several pressures and temperatures and the data is analyzed to give at least a qualitative confirmation of the Zernicke and Prins relation. The small angle scattering is also analyzed for "particle" sizes corresponding to the size of the regions of discontinuity. No indication that there is a systematic change in the size of these regions under different thermodynamic conditions of the fluids results from this analysis. 100 pages. \$1.25. MicA54-3126

INVESTIGATIONS OF CERTAIN FREQUENCY DEPENDENT ELECTRICAL PROPERTIES OF BIOLOGICAL MATERIALS

(Publication No. 10,067)

Philip Henri Cholet, Ph.D.
Syracuse University, 1954

The purpose of this work was to investigate the electrical properties of living cells and to demonstrate an effect of low frequency electric fields on the same material.

The cell is considered as a conducting sphere of several microns diameter, surrounded by an insulating membrane, inside of which exists a complex of ions and a gel structure mainly of polar proteins. This type of structure predicts the electrical characteristics observed in cells and tissues. A suspension of cells, or a tissue would be expected to show conductance through intercellular fluids at low frequencies, and at high frequencies a predominating susceptibility component.

Due to the presence of polar molecules and ions, it might also be possible to produce molecular or ionic reorientation in particles weakly bound. This would be observed as a change in dissipation factor and dielectric constant, producing changes in the equivalent parallel resistance.

The material chosen for experiment was the viable grain of Zea Maize. This has low moisture content, and ease of statistical treatment.

Two separate approaches were followed. The first consisted of irradiation of dry seeds at various frequencies, varying field strengths, times of exposure, moisture content, and temperature. Statistical investigation of changes in germination percentages of these treated seeds was made and compared with suitable controls.

The second experimental approach was measurement of dielectric constant, dissipation factor, and equivalent parallel resistance of the grain with varying conditions of temperature and moisture content.

Study of germination percentages for various treatments seldom reveals more than one-half percent difference between the controls and test samples. One case showed a 1.1% difference, which is statistically insignificant. It is concluded that there was no specific effect demonstrated for any frequency.

Fields of 60,000 volts per centimeter produced heating effects which raised the temperature 20°C, but for the conditions for the other experimental work, temperature rises of only 1 to 2°C were noted. This temperature rise, and a possible statistical indication of an overall trend toward lower germination percentage for the entire group of test samples, were the only effects demonstrated by irradiation.

The search for molecular absorption in seeds showed only two frequencies producing a reliable indication. Graphs of resistance vs. frequency with changing moisture content show distinct absorption at 300 kilocycles/sec., for moisture contents above 20%

by weight. This absorption frequency corresponds to that expected for ice, when extrapolated to room temperature. It is concluded that a certain amount of the cell moisture is in a highly oriented form similar to that found in ice. Another absorption maximum was found at one megacycle/sec. at -180°C , apparently due to a molecule whose room temperature absorption frequency occurs higher than possible in this work.

Graphs of equivalent parallel resistance at various frequencies as a function of temperature are linear on a semi-log plot. These are typical of ionic conduction whose activation energy is calculated under these conditions as .2 electron volts. It is concluded that increases in low frequency dielectric constant and dissipation factor are due to ions moving in a viscous medium, rather than a specific property of large molecules in the cells.

Calculations based on room temperature data regarding the DC capacitance, parallel conductance, and space charge capacitance indicate about 5×10^{11} charge carriers per cubic centimeter, and having a mobility of $1.2 \times 10^{-9} \text{ cm}^2/\text{volt-second}$. The agreement of experimentally determined curves with those predicted by theory indicate these calculations to be of the correct order of magnitude.

59 pages. \$1.00. MicA54-3127

AN APPLICATION OF THE SCINTILLATION SPECTROMETER WITH NaI AND ANTHRACENE PHOSPHORS

(Publication No. 9934)

Robert Justice Kerr, Ph.D.
Vanderbilt University, 1954

Supervisor: Dr. S. K. Haynes

This thesis was concerned with two separate problems. The first problem was the measurement of the K-shell internal conversion coefficient of the .342 Mev electromagnetic transition in Lu^{175} with an anthracene phosphor in a scintillation spectrometer. The second problem was an investigation of the spectrum of the gamma radiation of I^{131} from the thyroid of a patient and the design of a phantom source to simulate this spectrum in the energy region above .250 Mev.

The experimental value of the conversion coefficient of an electromagnetic transition often permits classification of the transition as to multipole order and character. This information is then valuable in fitting the transition into a reasonable disintegration scheme for the nucleus. The scintillation counter is very useful for measuring conversion coefficients of transitions such as this one in Lu^{175} , which is produced by K capture from Hf^{175} and has no continuous beta-ray spectrum accompanying it.

Electron and gamma-ray intensities from the transition were measured by means of differential spectra taken by the anthracene spectrometer with and without an electron absorber. These intensity

measurements were then compared with similar measurements made on the radiations from the .411 Mev electromagnetic transition in Hg^{198} and the .279 Mev transition in Tl^{203} , whose conversion coefficients are known, to calculate the conversion coefficient for the .342 Mev transition. This comparison method of calculating conversion coefficients was first developed by Cook and Haynes¹ to compensate for inherent inaccuracies in electron and gamma-ray intensity measurements made with the flat crystal anthracene spectrometer.

On the basis of the value, $.124 \pm .013$, obtained for the K-shell conversion coefficient for the .342 Mev transition in Lu^{175} , it was given the magnetic dipole assignment.

In the second problem with which this thesis is concerned, the scintillation spectrometer pulse spectrum of the scattered gamma radiation from I^{131} in a patient's thyroid was analyzed into the gamma ray distribution. To get the pulse spectrum of the scattered gamma radiation, the pulse spectrum of a point source of I^{131} was subtracted from the pulse spectrum of the radiation from the thyroid of a typical patient who had received a dose of I^{131} .

To analyze the above "difference spectrum," the Compton and full-energy distributions in the scintillation, spectrometer pulse spectrum of monoenergetic gamma rays were approximated as closely as possible by a distribution consisting of three adjacent rectangles. The shape of this distribution and its variation with gamma-ray energy were worked out with the aid of measured pulse distributions from gamma rays of Cs^{137} , Au^{198} , Hf^{175} , and Hg^{203} , which have the energies, respectively, .661 Mev, .411 Mev, .342 Mev, and .279 Mev. The difference pulse spectrum was then filled in with approximate pulse distributions of monoenergetic gamma rays of appropriate energies. Total area of these approximate pulse distributions at each energy increment, represents the number of gamma rays of that energy stopped or scattered in the NaI crystal. When this area is divided by the fraction of gamma rays, traversing the crystal, which were actually stopped or scattered, the relative number of gamma rays of that energy from the source is obtained.

Results of this analysis gave a gamma-ray distribution which increased from almost no intensity at $\sim .364$ Mev, reached a maximum at about .179 Mev, decreased toward lower energy until about .050 Mev, which was the lowest energy dealt with. If it is assumed that most of the scattered gamma rays come originally from the main .364 Mev gamma ray in I^{131} , then the $\sim .179$ Mev maximum in the scattered distribution represents gamma radiation which has been scattered through an angle of about 120° . This is evidence that tissue at the side of and behind the neck scatter appreciable amounts of radiation into a counter in front of the neck.

Phantom sources are employed in the measurement of the I^{131} content of the thyroid by external gamma-ray counting, a widely used diagnostic test. By simulating the scattering and absorption effects and the effective geometry of the neck, the phantom improves the accuracy of I^{131} content determinations

which are usually made by comparing gamma-ray counting rate over the neck with that over a known source of I^{131} . However, most phantom sources have been designed to give accurate results with only one particular counting setup.

For simplicity, the phantom used here was constructed by immersing a volumetric flask, containing 50 cm³ of an I^{131} solution, in a 2 liter beaker of water. NaI scintillation spectra were used as means of comparing the phantom to the average human neck as an I^{131} gamma-ray source. The position of the flask in the beaker was chosen so that the phantom pulse spectrum would duplicate, as closely as possible, the average pulse spectrum from a patient's neck, in the energy region above .250 Mev. With any scintillation counter, set to accept only gamma rays above this energy, very accurate comparative measurements of thyroid I^{131} content should be obtained.

A slight correction factor will be needed for differences in effective source-to-detector geometry between neck and phantom which were not compensated by duplication of spectra in this manner. This should be readily obtained by measurement of effective sources to detector distances for neck and phantom.

116 pages. \$1.45. MicA54-3128

1. T. B. Cook and S. K. Haynes, Phys. Rev. 86, 190 (1952).

ANGULAR DISTRIBUTION OF PHOTOELECTRONS PRODUCED BY 0.4 TO 0.8 MEV. POLARIZED PHOTONS

(Publication No. 9655)

William Herbert McMaster, Ph.D.
University of Virginia, 1954

The angular distribution of high energy (0.4 - 0.8 Mev.) photoelectrons produced in Pb and Au foils by linearly polarized photons has been investigated using scintillation counting and pulse height analysis techniques. A Compton scattered photon beam from Co⁶⁰ provided a source of partially polarized radiation. The cross section for the distribution of K-shell photoelectrons was first calculated by Sauter¹ using Dirac's relativistic wave equation. The cross section is of the form

$$d\sigma = A + B \cos^2 \phi,$$

In the non-relativistic limit the second term predominates in agreement with non-relativistic calculations. For high energies ($> \sim 0.5$ Mev.), the first term, containing the square of the energy, predominates,² and the second term becomes negative resulting in photo-emission predominately orthogonal to the electric vector of the incident photon. Experimental results confirm this phenomenon and are in good agreement with the distribution predicted by Sauter.

72 pages. \$1.00. MicA54-3129

1. F. Sauter, Ann. Physik 11, 454 (1931)

2. F. L. Hereford and J. P. Keuper, Phys. Rev. 90, 1043 (1953)

AN ELECTRON DIFFRACTION STUDY OF ALLOYS PRODUCED BY THE SIMULTANEOUS VACUUM EVAPORATION OF ALUMINUM AND COPPER

(Publication No. 9559)

Neal Pope Rowell, Ph.D.
University of Florida, 1954

A vacuum evaporation unit was constructed with two independent filaments in a 15 inch diameter bell jar. A shutter arrangement was incorporated which enabled aluminum and copper to be evaporated simultaneously from the two filaments. Samples of the alloys produced were collected on collodion covered grids. Rates of deposition and masses per unit area of the samples were computed. Electron diffraction patterns and micrographs were obtained with a Philips electron microscope. The alpha and kappa phases of the alloys were obtained. In the region from nine to forty-six percent aluminum the diffraction patterns obtained did not agree well with X-ray diffraction patterns obtained by other workers for the accepted stable alloy phases in this region. The patterns obtained in this region in this study appeared to be due to a face-centered cubic structure which became progressively more ordered as the aluminum content increased. The effects of the electron beam on the samples and the errors involved in the diffraction analyses are discussed. No heat treatment was given to any of the alloy samples.

97 pages. \$1.21. MicA54-3130

FREQUENCY DEPENDENCE OF ACOUSTIC CAVITATION

(Publication No. 7590)

Garland Leon Thomas, Ph.D.
University of Missouri, 1954

Supervisor: A. R. Laufer

Apparatus has been developed and constructed for producing acoustic cavitation in liquids by using plane, standing waves at seventeen discrete frequencies between 300 kc/s. and 5000 kc/s. Detection of the cavitation onset was achieved by detecting the characteristic cavitation noise.

A method of hydrophone calibration has been developed whereby the radiation pressure on the hydrophone of a vertical sound beam is measured when the hydrophone is suspended from a Jolly balance spring. A trapping effect has been observed but found not to interfere with the calibration. The calibration method is applicable to standing waves. After calibration, the hydrophone is used to simultaneously: (1) serve as sound reflector to produce standing waves, and (2) measure the acoustic pressure in the standing wave system.

Measurements of the peak acoustic pressure required for cavitation onset were made as a function of the sound frequency. The peak acoustic pressure

required to produce cavitation was found to be approximately 2 atmospheres for Transil Oil and approximately 1 atmosphere for fresh tap water and non-degassed kerosene. In each case, the required acoustic pressure was found to be approximately constant throughout the frequency range measured.

134 pages. \$1.68. MicA54-3131

PHYSICS, ELECTRONICS & ELECTRICITY

A STUDY OF THE LUMINESCENCE AND CONDUCTIVITY DECAY OF ZINC SULFIDE AND SILVER CHLORIDE

(Publication No. 9786)

Michael Waldner, Ph.D.
Cornell University, 1954

The decay of the luminescence and of the dielectric constant and losses (or conductivity) were measured as a function of time after ultraviolet excitation for two types of zinc sulfide phosphor powders and for silver chloride single crystals.

The experimental results on a silver activated hexagonal zinc sulfide phosphor gave good agreement with the results predicted upon the basis of a model describing the dielectric properties under illumination in terms of photo-conducting regions and regions of high resistance in the material. On the basis of this model, it was found that the intensity of the luminescence is proportional to the number of conduction electrons.

The experimental results for a silver activated cubic zinc sulfide indicated that the high resistance regions were absent, at least at room temperature.

Both a fast and a slow decay of the luminescence and d.c. conductivity were observed in the case of single crystals of silver chloride. The time constant of the fast decay of the luminescence was independent of the intensity and wavelength of the exciting radiation. Although the conductivity decays also consisted of a fast and a slow part, there appeared to be no simple connection between the luminescence and the conductivity decays. The fast decay of the d.c. conductivity had a life-time of about 10 microseconds. Large variations, between samples, were observed in the lifetime of the slow decay. The slow decay was not exponential; the time needed to decay to $1/e$ of the original conductivity was from 0.25 to 0.50 milliseconds for the samples measured.

103 pages. \$1.29. MicA54-3132

PHYSICS, NUCLEAR

THE SCATTERING OF HIGH ENERGY ELECTRONS BY HEAVY NUCLEI

(Publication No. 9732)

Gertrude Elizabeth Urey Baranger, Ph.D.
Cornell University, 1954

The elastic scattering of high-energy electrons is a tool which can be used to obtain information on the radius and charge distribution of nuclei. There have been several numerical calculations of this process. Although the numerical method will undoubtedly remain the most accurate, it may be thought that an analytical solution, even if approximate, would help in the understanding of the physical happenings and would show more clearly the dependence on the various parameters involved. The Born approximation is such an analytical method; however, it cannot be trusted for such heavy nuclei as gold or lead, because $Ze^2/\hbar c$ is too large.

To calculate the scattering amplitude, the partial wave analysis is used, where the phase shifts are found approximately by the WKB method. This method is applicable if the potential varies slowly over distances of the order of the electron wavelength. This is the case if $kR \gg 1$, where R is the radius of the nucleus and $k = \frac{1}{\lambda}$ is the electron wave number. We feel that $kR = 5$ is about the lower limit of the energy region where the WKB method can be considered valid.

We start from the Dirac equation and neglect the mass of the electron. In that case the phase shift η depends only on the angular momentum j , and not on the parity. We apply the WKB method in the form given by Bessey and Uhlenbeck, with the result

$$\eta_j = \lim_{r \rightarrow \infty} \left\{ \int_{r_0}^r Q(r') dr' - kr - \alpha \ln 2kr + \frac{l\pi}{2} \right\} \quad (1)$$

where $Q(r) = [(k - V(r)/\hbar c)^2 - l^2/r^2]^{1/2}$; $V(r)$ is the potential energy; r_0 is the turning point, i.e., $Q(r_0) = 0$; $\alpha = Ze^2/\hbar c$; and l is defined as $j + \frac{1}{2}$.

The cross section is conveniently written in the following form:

$$d\sigma/d\Omega = \sec^2 \frac{\theta}{2} |f(\theta)|^2$$

$$f(\theta) = \frac{1}{2ik} \sum_j l (e^{2i\eta_j} - 1) [P_l(\cos \theta) + P_{l-1}(\cos \theta)] \quad (2a)$$

$$f(\theta) = f^c(\theta) + \frac{1}{2ik} \sum_j l (e^{2i\eta_j} - e^{2i\eta_j^c}) [P_l(\cos \theta) + P_{l-1}(\cos \theta)] \quad (2b)$$

where η_j^c is the Coulomb phase shift and $f^c(\theta)$ is the Coulomb scattering amplitude which has been calculated, at high energies, by Feshbach, and more recently by Yennie *et al.*

The number of terms in the summation in (2b) is of the order kR . This sum was done exactly using the WKB phase shifts for the uniform and shell charge distributions with $kR = 5$ and 10 and with $Z = 80$. It should be noted that the cross section depends only on the combination kR , except for a factor $1/k^2$. The result compares favorably with the numerical one of Yennie et al. There is no agreement between this calculation and the Born approximation. The maxima and minima of the Born approximation are greatly smoothed out, especially the first one, and shifted to smaller angles.

This cross section can be compared with the results of the experiments of Hofstadter et al. Yennie et al have shown that by using $R = 1.1$ to $1.2 A^{1/3} \times 10^{-13}$ cm. the result for 125 Mev for the uniform distribution is not inconsistent with the data. This is borne out by the WKB curves. However, the WKB curve for 153 Mev using this smaller radius is inconsistent with the experimental data. It is impossible to fit the data using the shell distribution.

In order to find an analytic expression for the scattering amplitude one must do the sum in equation (2a). If we assume kR is very large, but keep $\beta = 2kR \sin \theta/2$ about constant, we can replace $P_l(\cos \theta) + P_{l-1}(\cos \theta)$ by $2J_0(\beta x)$ and replace the sum by an integral and can make simplifications in the phase shifts. It then becomes evident that there are cancellations which leave the result much smaller than the Coulomb amplitude. The method also shows that the Born approximation is only one of several terms which must be taken into account. When one compares

$$\left| \frac{ikf(\theta)}{C(kR)^{2-2i\alpha}} \right|^2$$

for large kR with the numerical results for $kR = 5$ and 10 , it is seen that the curve for large kR is shifted to larger β , but the general shapes are the same. One can hope to reproduce the numerically calculated curves by improving the approximations, but an increase in accuracy is obtained only at the expense of analytical simplicity.

64 pages. \$1.00. MicA54-3133

THE DISINTEGRATION OF Ho^{164}

(Publication No. 9044)

Hugh Needham Brown, Ph.D.
University of Illinois, 1954

Samples of holmium oxide and holmium metal, irradiated with 22 Mev bremsstrahlung, yielded a 36.7 ± 0.5 min beta activity, attributed to Er^{164} , in agreement with published values listed by K. Way.¹ Pulse height measurements, with NaI(Tl) crystals and a proportional counter, indicated the presence of photons of energies 37, 46, 73, and 90 kev. The electron momentum-spectrum, obtained in a magnetic spectrometer, exhibited conversion electron

lines consistent with 73 - K, 37 - L, (37 - M and/or 90 - K), 46 - L, 46 - M, 73 - L, 73 - M, 90 - L, and 90 - M. The beta continuum was apparently complex, being consistent with two groups separated by 90 kev. The maximum disintegration energy of the beta decay was 990 ± 30 kev, in good agreement with Wilkinson and Hicks.²

Pulse height measurements of radiations coinciding within $\frac{1}{4}$ micro-second showed 1) gamma-gamma coincidences between pairs of photons at 46 - 73, 46 - 46, and 46 - 37 kev, and 2) beta-gamma coincidences involving betas above 150 kev and 49- and 50-kev photons. In view of 2) a first excited state at 90 kev and with spin 2+ is hypothesized for Er^{164} , the 49-kev quanta being ascribed to Er K x-rays following the internal conversion of the 90-kev gamma-ray. The half-life of this state, determined from delayed beta-gamma coincidences, is $(1.4 \pm 0.5) \times 10^{-6}$ sec. Experiment 1) led to an assignment of levels in Dy^{164} at 73 kev and at 110 (= 73 + 37) kev above the ground state. The 73-kev state is thought to be 2+ from measurement of the K conversion coefficient, while the 110-kev level is probably 1, 2, or 3. Most of the 46-kev radiation is attributed to K x-rays following the electron capture process leading to Dy. No 37 min positrons were detected, the upper limit being 5×10^{-4} positrons per negatron.

Consideration of the intensity of the conversion electrons 46 - L and 46 - M makes it necessary to assume that a nuclear gamma-ray of 46 kev energy exists since the Auger electrons due to the K x-ray transitions could not account for the observed spectrum. Total absorption of the Ho^{164} radiations in a NaI crystal make the proposal of a 46-kev isomeric transition in Ho quite plausible from an examination of the number of pulses corresponding to various energies. This interpretation is not forced, however, and should be considered as only a reasonable guess.

The 73- and 90-kev levels in Dy^{164} and Er^{164} respectively conform to expectations suggested by published surveys of even-even nuclei.^{3,4} These low lying levels can be interpreted as collective-rotational states as described by Bohr and Mottelson.⁵ The 110-kev state in Dy^{164} , however, is in serious disagreement with a rotational spectrum. The configurational mixing discussed by de-Shalit and Goldhaber⁶ may shed some light on this question, but the situation is complicated by the fact that Bohr and Mottelson's analysis assumes that there is no other particle configuration lying close to the 73-kev level. An isomeric transition in the odd-odd nucleus Ho^{164} is seen to be consistent with numerous examples of such transitions in other nuclides. Bohr and Mottelson predict the existence of level pairs in odd-odd nuclei which differ little in energy but greatly in spin.

87 pages. \$1.09. MicA54-3134

1. Nuclear Data, NBS Circular 499 and Supplements.
2. G. Wilkinson and H. G. Hicks, Phys. Rev. **79**, 815(1950).
3. P. Preiswerk and P. Stäbelin, Il Nouvo Cimento **10**, 1219(1953).
4. G. Scharff-Goldhaber, Phys. Rev. **90**, 587(1953).

5. A. Bohr and B. R. Mottelson, Dan. Mat. Fys. Med. 27, #16(1953).

6. A. de-Shalit and M. Goldhaber, Phys. Rev. 92, 1211(1953).

IRRADIATION EFFECTS IN COPPER, SILVER, AND GOLD NEAR 10°K

(Publication No. 9059)

Howard Gordon Cooper, Jr., Ph.D.
University of Illinois, 1954

Electrical resistivity increases produced by 12 Mev deuteron irradiation were measured as a function of integrated deuteron flux in Cu, Ag, and Au. The bombardment temperature was near 10°K and no thermal recovery of the irradiation effects was observed; however, evidence that appreciable radiation annealing occurred during the bombardment was found. The resistivity increases near 10°K were much larger than those previously obtained in these metals for equal irradiations made near liquid nitrogen temperature. The observed Z-dependence of the irradiation effects agreed closely with that predicted by Seitz's theory.

Warmups made following the bombardments revealed that 40 to 50 percent of the total resistivity increase in Cu recovers near 43°K and from 13 to 24 percent of that in Ag anneals near 30°K; the rapid recovery in each case indicates that a unique process may be involved, and the associated activation energy is estimated to be 0.1 ev for both. It is suggested that volume diffusion of interstitial atoms or annihilation of very close interstitial atom-vacancy pairs are two possible processes responsible for the low temperature recovery. In addition, for all three metals, a gradual annealing rate was observed in the intermediate range 50°K-220°K and then a more rapid rate took place in the range 220°-280°K.

38 pages. \$1.00. MicA54-3135

PRODUCTION OF NEUTRONS FROM MESONS STOPPED IN VARIOUS ABSORBERS

(Publication No. 8975)

Dale Robert Jones, Ph.D.
Washington University, 1953

This thesis is a study of the production of neutrons by negative mesons which stop and interact in two materials, sodium and magnesium. The mean number of neutrons emitted per interaction was measured and found to be 0.6 ± 0.2 for magnesium and 1.0 ± 0.4 for sodium. The data confirm that relative neutron production in magnesium is less than in lead, but show that it is not zero. Neutron production in sodium is also shown to be non-zero and probably greater than in magnesium, though less

than in lead. The results are discussed qualitatively in relation to a hypothesis concerning the meson-nucleus interaction. 66 pages. \$1.00. MicA54-3136

NUCLEAR SPIN-LATTICE RELAXATION IN LIQUID AND SUPERCOOLED MENTHOL

(Publication No. 9112)

Burton Harlow Muller, Ph.D.
University of Illinois, 1954

The nuclear spin-lattice relaxation time (T_1) of liquid and supercooled *l*-menthol has been measured between 33.8°C and 49.0°C within an accuracy of $\pm 2\%$. There were three main purposes for this study: (1) Investigation of the success of the relaxation theory of Bloembergen, Purcell, and Pound in explaining relaxation in a liquid whose molecules are rather large and complicated; (2) A search for anomalies due to supercooling similar to those found in viscosity studies; (3) An attempt to explore the precision actually obtainable in measuring relaxation times.

It was found that: (1) The relaxation theory of Bloembergen, Purcell, and Pound provides a reasonably good prediction of the observed temperature dependence and the absolute magnitude of the nuclear spin-lattice relaxation time in both liquid and supercooled menthol as long as the CH_3 rotations within the molecule are taken into account; (2) The viscosity transition is not dramatically reflected in the magnetic resonance experiment. Our results are not sensitive enough to say whether or not the transition is reflected in a subtle fashion. A careful experiment in the linear region of $1/T_1$ vs. viscosity/temperature might be able to detect the transition; (3) T_1 can be measured to about 1% accuracy by the present experimental techniques.

54 pages. \$1.00. MicA54-3137

TIME OF FLIGHT MEASUREMENTS ON THE INELASTIC SCATTERING OF 14.8 MEV NEUTRONS

(Publication No. 9768)

Gerard Kitchen O'Neill, Ph.D.
Cornell University, 1954

Measurements have been made of the energy spectra of neutrons inelastically scattered from 14.8 Mev into the interval 0.5-4 Mev. Carbon, aluminum, copper, tin, and lead scatterers were used. In order to have a high counting efficiency, it was desirable to have an energy-measuring technique which required only a single neutron-interaction in a counter, but did not fail when the counter was made thick enough for multiple interactions to be important. The presence of a large background radiation due to 14.8 Mev neutrons which were detected directly or

after a scattering in nearby matter also made it desirable to select in some way the neutrons which had interacted with the desired scatterer. These requirements were met by the following method:¹ 100 Kev deuterons were extracted from a cyclotron and allowed to strike a target of Tritium absorbed in Zirconium. The resulting reaction $T(d,n)He$ (17.7 Mev in the center of mass system) yielded a 14.8 Mev neutron accompanied by a recoil 3 Mev alpha-particle. The two particles emerged in opposite directions due to momentum conservation, and the use of short-range incoming deuterons insured that all alpha-particles emitted in the backward direction would escape from the Zirconium foil. A scintillation counter within the vacuum system, subtending a solid angle of $4\pi/100$ at the target, detected recoil alpha particles with $\sim 100\%$ efficiency, delivering a fast signal whenever a neutron started on a path within a cone chosen to avoid all scattering material for a distance of several meters. Within the cone and close to the target a scatterer was placed, shaped to maximize the ratio of single to multiple neutron interactions. The inelastically scattered neutrons emerged from the scatterer with approximate isotropy, while few elastically scattered neutrons were deflected through large angles. A proton-recoil neutron counter placed at $\sim 90^\circ$ to the cone axis was thus prevented from detecting almost all undesired neutrons. The distance from the scatterer to the counter was 50 to 100 centimeters, and neutron energies were obtained from the measured flight-times over this path-length, with the recoil alpha signal serving as a time zero. The flight-times, which were from 20 to 65 millimicroseconds, were measured by a time-analyzer having nine 4.7×10^{-9} second channels, recording directly on mechanical registers. This analyzer had the property that all pulse-pairs within a 40×10^{-9} second interval were counted with unit efficiency. The over-all time resolution function for the system was approximately a Gaussian with a full-width at $1/e$ value of nine millimicroseconds. The results of the experiment were that neutron energies after scattering could be approximated by number/unit energy $E \approx E \exp(-E/T)$ with T , the "nuclear temperature" in Mev obtained from the raw data being: Pb, 0.75; Sn, 0.62; Cu, 0.84; Al, 1.06; C, 0.93. These results are in general agreement with photographic plate data.² The angular distributions were isotropic within the limits of error of $\sim 15\%$. In order to allow computation of counter efficiency as a function of neutron energy, the neutron counter was designed and operated to have nearly uniform sensitivity over its entire volume. Systematic errors in T due to finite time-resolution, the variation of counter sensitivity with energy, and multiple scattering were calculated as totaling less than 15% in any measured point, and over-all errors of 15% in the nuclear temperatures are assigned. 78 pages. \$1.00. MicA54-3138

1. G. K. O'Neill, Phys. Rev. 92, 853 (1953)

2. E. R. Graves and L. Rosen, Phys. Rev. 89, 343 (1953).

A CLOUD CHAMBER STUDY OF PROTON RECOILS FROM PARAFFIN RADIATORS BOMBARDED BY PO-BE NEUTRONS

(Publication No. 9936)

Richard Blaine Rhody, Ph.D.
Vanderbilt University, 1954

The detection of neutrons is based upon secondary effects which result from nuclear reactions. Fast neutrons are usually detected by being scattered elastically from some nucleus. In such a process the recoiling nucleus produces the ionization necessary for detection. Many neutron detectors and spectrometers use solid hydrogenous materials as a source of recoil protons. The widespread use of such solid "radiators" has suggested a study of the number of recoils from such targets as a function of neutron energy and radiator thickness.

In the course of this study a set of relations that allow the prediction of the number of recoils from hydrogenous slabs has been derived. These equations give the number of recoils as a function of the incident neutron energy, the radiator thickness, and the energy of the recoil proton after it leaves the radiator. These relations are applicable to both thick and thin targets. A thick target is one in which the target is thicker than the range of the most energetic recoil; while a thin target is thinner than the recoil range. The equations are derived under the assumption of isotropic scattering in the center-of-mass system and are based on a single neutron-proton collision in the target. The assumption of spherical symmetry limits the usefulness of the relations to a range of neutron energies of about 0.4 to 15 Mev. Such relations as these are of value in the design of neutron detectors and counters.

To check the relations discussed above a cloud chamber study of recoil protons from paraffin radiators was made. The chamber was a diaphragm type Wilson cloud chamber about 18 cm in diameter and 6.5 cm deep. Two 35mm cameras are mounted at 40° to each other to give wide-angle stereoscopic pictures. Paraffin radiators of thicknesses 25.1, 41.5, 68, 90.5, and 115.2 mg/cm² were prepared by the evaporation of paraffin, under partial vacuum, onto brass discs. The radiators were placed inside the cloud chamber normal to both the center plane of the chamber and the neutron beam. A Po-Be neutron source with a flux of about 5×10^6 n/sec was used. It was suspended outside the chamber about 29 cm from the radiators.

To calculate the number of recoils expected the relations derived were evaluated for each target thickness and integrated over the known neutron energy spectrum of the Po-Be source. Such calculations gave the number of recoils with energy greater than a given value. The evaluation was made for recoils of 1 to 9 cm in length. The experimental data were analyzed according to recoil length in 1 cm intervals. 10,127 pictures were scanned and 3023 tracks accepted for measurement. Comparison of the experimental and calculated yields was made by plots of integral and differential range distributions. The

former is a representation of the number of recoils greater than a given length, while the latter is the number of recoils of given length per unit length interval. The integral distributions were in very good agreement with the calculated curves; whereas, the differential distributions agreed as well as could be expected within the statistics of this experiment.

An investigation of the angular distribution of recoils from the radiators was also made. The assumption of isotropic scattering mentioned previously means that the angular distribution in the laboratory system should follow a $\sin 2\theta$ curve; that is, it should have a maximum at 45° . This would be true if the recoils did not have to traverse some of the radiator material before they were detected. The protons that recoil at a large angle must traverse a large radiator thickness and thus have less chance of being detected. This should make the maximum of the angular distribution shift towards a smaller angle. This shift was found in our investigation. The maximum number of recoils was found at about 30° . The angular distribution seems to be nearly independent of the radiator thickness for the range of targets used in this study.

91 pages. \$1.14. MicA54-3139

THE ELECTRICAL RESISTIVITY OF COLD-WORKED ALUMINUM SINGLE CRYSTALS

(Publication No. 9148)

Abraham Sosin, Ph.D.
University of Illinois, 1954

Mechanical deformation of a metal introduces a variety of imperfections into the lattice. A primary problem in solid-state physics today is to identify these imperfections and establish their characteristics and interactions. Electrical resistivity measurements have been extensively employed on metals. Since different imperfections such as vacancies, dislocations and interstitials should scatter conduction electrons with different symmetries, measurement of resistivity as a function of crystallographic direction should yield information on the nature and number of imperfections introduced on cold-working.

It has also been previously shown that resistivity increases due to crystal-damage recover at very low temperatures. If we assume that the recovery corresponds to the annealing of some defect, valuable information should be gained by combining direction resistivity measurements with recovery studies.

To accomplish this program, single crystals of high-purity (99.99 +%) aluminum have been pulled in tension. Aluminum was chosen since it is initially electrically and, nearly, elastically isotropic. Single crystals were used to study the possible anisotropy of resistivity. To obtain the simplest conditions for this study, both physically and analytically, crystals oriented for a large amount of single slip were used.

To "freeze in" all the resulting imperfections as

well as to obtain the required accuracy, the crystals were immersed in a liquid helium bath (4°K) during deformation and measurements. While a current of approximately 20 amperes was passed axially, potential drops on the order of 0.5 microvolts were measured between pure aluminum probes cast into place when the single crystal was grown.

Following some extension (e.g., 10%) at 4°K , the crystals were warmed to 78°K and, later, 300°K , to allow recovery to take place. Electrical measurements were repeated after each warm-up at 4°K .

The results showed a rather complete absence of any anisotropy of resistivity in the initial increase due to deformation or in the subsequent decreases due to recovery. This result is reliable to 5-10% in two components of the diagonal resistivity tensor (in the principal axis system) but only to 20-50% in the third component due to the nature of the experiment and the crystal structure.

Theoretical calculations of the relative contribution to resistivity show vacancies to be about 15 times more effective in scattering electrons than dislocations. Since vacancies, unlike dislocations, should scatter symmetrically, the results may confirm in this calculation. Other experimental results are:

1. Approximately 15% of the total resistivity increase recovers below 78°K .
2. A crystal deformed at 78°K behaves in its resistivity similar to one that has been deformed at 4°K and warmed to 78°K .
3. Approximately 55% of the total resistivity increase recovers in the range of -80°C to -120°C , recovering faster at lower temperatures with higher strains.
4. The resistivity increase is proportional to the square of the applied stress.
5. The stress-strain curve is linear at 4°K for extensions up to 10%.
6. The stress-strain curve is parabolic at 78°K and 300°K .
7. Softening of the crystal occurs between 78°K and 300°K .
8. An aging phenomenon is observed for crystals pulled at 4°K and 78°K .
9. The stress-strain curve is orientation-dependent. The slope of the curve may vary by a factor of two.

68 pages. \$1.00. MicA54-3140

THE EXPERIMENTAL DETERMINATION OF THE ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR THE $\text{O}^{16}(\text{d,p})\text{O}^{17}$, $\text{O}^{16}(\text{d,p})\text{O}^{17*}$ AND $\text{O}^{18}(\text{d,p})\text{O}^{19*}$ REACTIONS AS A FUNCTION OF THE INCIDENT DEUTERON ENERGY AND THE ANGLE OF THE EMITTED PROTONS

(Publication No. 9624)

Thomas Fairlamb Stratton, Ph.D.
University of Minnesota, 1954

0.04 mil nickel foils were oxidized with oxygen enriched to 23% O^{18} to form self supporting NiO

targets containing approximately 10^{19} oxygen atoms per square centimeter. Comparison of the yield of reaction products with deuterons incident on normal and enriched targets showed one new proton group due to the O^{18} target. The experimentally determined Q for the reaction was 0.3 ± 0.2 Mev. Assuming a mass defect of 8.65 Mev^2 for O^{19} places the excited state in O^{19} at about 1.6 Mev. The differential cross section per unit solid angle for the reaction was measured for 3.01 Mev deuterons at twenty center-of-mass angles ranging from 5° to 161° . The distribution was of the character of a typical $l_n = 0$ type stripping distribution with a cross section of 213 mb. at 5° falling to a minimum of 11 mb. at 48° and rising to a secondary maximum of 27 mb. at 84° . Attempts to resolve the ground state protons from $O^{18}(d,p)O^{19}$ and $O^{16}(d,p)O^{17}$ failed, indicating that the Q 's for these reactions are the same within the resolution of our detectors, 0.4 Mev.

NiO foil targets as described in the preceding paragraph were bombarded with incident deuterons of laboratory energies 2.3 Mev to 3.9 Mev. The absolute yield of the $O^{16}(d,p)O^{17}$ ground state reaction was measured at $\theta_{cm} = 53^\circ$ in 35 kev steps over the indicated energy range. A resonant type yield was obtained with differential cross sections at $\theta_{cm} = 53^\circ$ of 17 mb. at 2.65 Mev, 33 mb. at 3.01 Mev, 19 mb. at 3.25 Mev and 31 mb. at 3.43 Mev. Angular distributions³ obtained over twenty-two center-of-mass angles from 5° to 161° at these four deuteron energies showed a forward maximum at 53° falling to a minimum of 13 mb. in the neighborhood of 90° and rising gradually to 16 mb. in the back angles. Fluctuations of intensity at the forward maximum provided the major contribution to maxima in the total yield at 3.0 Mev and 3.4 Mev. The differential cross section for the $O^{16}(d,p)O^{17*}$ reaction (.875 Mev level) was measured at 3.01 Mev and 3.43 Mev. The distribution obtained was of the typical stripping type with $l_n = 0$. 102 pages. \$1.28. MicA54-3141

1. Courtesy of Professor A. O. Nier.
2. E. Bleuler and W. Zunti, *Helv. Phys. Acta* **20**, 195 (1947).
3. N. P. Heydenburg and D. R. Inglis, *Phys. Rev.* **73**, 230 (1948).

NUCLEAR SCATTERING OF HIGH ENERGY NEUTRONS AND THE OPTICAL MODEL OF THE NUCLEUS

(Publication No. 9784)

Theodore Brewster Taylor, Ph.D.
Cornell University, 1954

The optical model of the nucleus has been re-examined in the light of recent measurements¹⁻⁴ of the total neutron cross sections of various nuclei for neutron energies ranging from 40 Mev to 410 Mev. Using the nuclear model and method of calculation described by Fernbach, Serber, and Taylor,⁵ an

attempt was made to fit the measured cross sections by adjusting the values of the nuclear radii, R , the inverse mean free path for absorptions of neutrons in nuclear matter, K , and the average potential, V , encountered by a neutron inside a nucleus. Both K and V were allowed to depend upon the neutron energy, but were assumed to be the same for all nuclei.

It was found that all of the existing data on total cross sections for neutron energies greater than 40 Mev can be satisfactorily accounted for by using the following nuclear parameters:

1) Nuclear radii equal to $(.8+1.23 A^{1/3}) \times 10^{-13} \text{ cm.}$, where A is the nuclear mass number, provide the best fit to the data, and insistence upon reasonable agreement with all of the data determines the radii to within about $\pm 3\%$. The constant term in the formula for the radius as a function of $A^{1/3}$ is believed to be due to the range of nuclear forces.

2) K is nearly independent of neutron energy for the energy range considered and is equal to $(.18 \pm .04) \times 10^{13} \text{ cm.}^{-1}$ for energies above 50 Mev. Calculations of K , using the measured free nucleon-nucleon cross sections and the Fermi gas model of the nucleus, give the result that K is constant to within about 10% within the neutron energy range considered, but is as much as 50% higher than the values of K extracted from the nuclear cross sections.

3) V is about 25 Mev for neutron energies of 40 Mev, rises to 32 Mev at 60 Mev, drops very rapidly to 10 Mev for neutron energies of about 200 Mev, and remains constant for higher neutron energies. The resonance-like behavior of V is required by the presence of sharp minima in the measured cross sections of the heavy elements for neutron energies near 60 Mev and the lack of such minima in the cross sections of elements as light as iron. There are questions about the validity of the approximations used in solving the scattering problem at such low energies; it is suggested that measurements of the small angle elastic scattering of neutrons by lead and by copper would provide a means for determining whether the "resonance" really exists.

It seems reasonable to attribute the rapid drop in V as a function of energy to the presence of a large repulsion at small distances in the nucleon-nucleon interaction. 57 pages. \$1.00. MicA54-3142

1. A. E. Taylor and E. Wood, *Phil. Mag.* **44**, 95 (1953).
2. W. I. Linlor and B. Ragent, *Phys. Rev.* **92**, 835 (1953).
3. B. Ragent, UCRL-2337, Berkeley (1953).
4. V. A. Nedzel, *Phys. Rev.* **94**, 174 (1954).
5. S. Fernbach, R. Serber, and T. B. Taylor, *Phys. Rev.* **75**, 1352 (1949).

PHOTOPRODUCTION OF LOW ENERGY CHARGED π MESONS

(Publication No. 9901)

James Richard Voss, Ph.D.
Purdue University, 1954

Major Professor: Robert O. Haxby

In order to measure the effect of the nuclear Coulomb field on meson production, an experiment was performed measuring the low energy positive and negative π mesons produced in C, Cu, Sn, and Pb by the γ -rays in the 284 ± 8 Mev. bremsstrahlung of the Purdue 300 Mev. Electron Synchrotron. Mesons produced at 90° and 120° were detected with Ilford 600 micron G-5 Nuclear Research Plates. After processing, these plates were scanned with a microscope and mesons were identified by the tracks left in the sensitive photographic emulsion. Mesons observed with energies below 20 Mev. had positive to negative production ratios smaller than these ratios for mesons produced at higher energies. In the case of lead this suppression of the plus to minus ratio was the strongest; no positive mesons were found with energies as low as 10 Mev. The suppressions at low energies for Cu and Sn were very noticeable, but not as strong as for lead. The plus to minus ratios for Cu, Sn, and Pb were zero for observed meson energies less than the calculated Coulomb barriers, 7.5, 10.5, and 13.7 Mev., respectively. The experimental resolution of energy was not sufficient to determine whether or not there were positive π mesons produced from C with energies less than the Coulomb barrier, 2.7 Mev. The positive to negative π meson ratio was measured at 70 Mev. and found to agree within statistical errors with values found by other experimenters.

Absolute differential cross sections for both positive and negative π mesons were determined for the four materials. The carbon cross section for positive mesons was found to be about 50% of the value found by other experimenters using higher energy bremsstrahlung. The absolute cross sections found for 20 Mev. π mesons are:

$$\begin{aligned} \text{C } \sigma_{\pi^+} &= (1.0 \pm .35) \cdot 10^{-31} \text{ cm}^2/\text{steradian-effective} \\ \sigma_{\pi^-} &= (2.1 \pm .7) \cdot 10^{-31} \text{ quantum-Mev.} \\ \text{Cu } \sigma_{\pi^+} &= (2.9 \pm .9) \cdot 10^{-31} \\ \sigma_{\pi^-} &= (7.2 \pm 1.7) \cdot 10^{-31} \end{aligned}$$

$$\text{Sn } \sigma_{\pi^+} = (6.7 \pm 2.5) \cdot 10^{-31}$$

$$\sigma_{\pi^-} = (1.6 \pm .5) \cdot 10^{-30}$$

$$\text{Pb } \sigma_{\pi^+} = (2.9 \pm 1.2) \cdot 10^{-31}$$

$$\sigma_{\pi^-} = (2.4 \pm .5) \cdot 10^{-30}$$

The errors quoted for these cross sections are estimated standard deviations including both statistical and systematic errors.

71 pages. \$1.00. MicA54-3143

THE ELASTIC PHOTO-PRODUCTION OF π^0 MESONS FROM DEUTERIUM

(Publication No. 9803)

Bertram Wolfe, Ph.D.
Cornell University, 1954

The reaction $\gamma + D \rightarrow \pi^0 + D$ has been investigated for γ -ray energies between 250 and 300 Mev at four different angles of emission of the π^0 , between 76° and 130° in the laboratory. At each angle an event was recorded when a recoil deuteron in the required energy and angular range was in coincidence with a π^0 decay γ -ray, the γ -counter being placed at the correlated π^0 angle.

The deuteron was detected in a two scintillation crystal telescope, dE/dx being measured in the first (thin) crystal and the energy in the second. The product $E dE/dx$ was obtained electronically. This product is proportional to $M^{0.8} Z^2$ so that particles of different mass and/or charge can be distinguished. The identification technique is described in detail.

The elastic production is of interest because it depends strongly on interference effects between the production of the π^0 on the neutron and on the proton in the deuteron. Comparison of the experimental results with theoretical predictions made on the basis of the impulse approximation indicates that the interference is constructive, i.e. the production amplitudes from the neutron and proton add (vs. destructive interference when they subtract). The connection between this result and meson theory is discussed.

The cross section for the elastic production of π^0 mesons increases monotonically from $1.2 \pm .3$ microbarns per steradian at 130° for the π^0 in the laboratory to $4.2 \pm .6$ microbarns per steradian at 76° . There is an uncertainty of 20% in the normalization of these relative cross sections.

113 pages. \$1.41. MicA54-3144

PHYSIOLOGY

A STUDY OF THE EFFECTS OF 17-VINYLTTESTOSTERONE IN THE RAT WITH PARTICULAR REFERENCE TO ADRENAL FUNCTION

(Publication No. 10,062)

Theda Elizabeth Bennett, Ph. D.
Syracuse University, 1954

The effects of 17-vinyltestosterone in normal, castrate, unilateral adrenalectomized and hypophysectomized rats were studied and compared with the effects of testosterone propionate following daily subcutaneous injections of the steroids in sesame oil.

17-Vinyltestosterone exhibited weak androgenic effects in comparison to testosterone propionate. At five milligram doses daily for thirty days, its effects upon testis, thymus, seminal vesicles and ventral prostate weights paralleled the effects of one-tenth milligram of testosterone propionate.

In contrast to testosterone propionate, vinyltestosterone reduced adrenal size and weight markedly in normal and ovariectomized female rats and in normal male rats. Adrenals of hypophysectomized females were also significantly reduced. This effect upon adrenal weight was not paralleled by any marked decrease in adrenal function. No decrease in response to administered water doses was demonstrated. Some decreased survival following exposure to the chronic stress of cold was noted.

Although pituitary weight was markedly decreased in vinyltestosterone-treated animals, no reduction in ACTH activity per milligram of adrenal tissue could be demonstrated. The method of Sayers, Sayers and Woodbury was employed. Total ACTH content of the gland might, however, be reduced.

Vinyltestosterone in two and one-half milligram and five milligram doses daily for thirty days decreased the weight of ovaries more than the same dose of testosterone propionate, but did not increase ovarian weight in hypophysectomized females as did testosterone propionate. Uterine weight was decreased in normal females, but increased in spayed and hypophysectomized females, following treatment with vinyltestosterone. This compound did not affect thyroid or kidney weight.

Vinyltestosterone exhibited an anti-estrogen effect upon the pituitary, testis and upon the uterus. There was no marked anti-estrogen effect upon the adrenal. Estradiol benzoate was administered to immature normal male rats to determine anti-estrogenic properties of vinyltestosterone. Estradiol benzoate augmented the effect of vinyltestosterone upon the thymus, seminal vesicles, and prostate.

Vinyltestosterone, in contrast to testosterone propionate, did not inhibit lactation. It stimulated growth of mammary glands in immature rats.

Adrenal compensatory hypertrophy following unilateral adrenalectomy was inhibited by vinyltestosterone, although histological examination of these adrenals showed markedly hypertrophying tissue.

Evidence relating to the possible mechanism of action of vinyltestosterone is discussed. It is suggested that vinyltestosterone has a direct action upon the adrenal gland, not mediated by pituitary or gonad. 102 pages. \$1.28. MicA54-3145

BODY COMPOSITION AS RELATED TO HEAT REGULATION IN WOMEN

(Publication No. 9600)

Lionel Mandel Bernstein, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1954

The present investigation was undertaken (a) to determine the relative size of the various body components in young and aged normal and obese women and (b) to relate these determinations to basal heat production and to heat loss on exposure to cool and hot environments in the obese and in the euthyroid and hyperthyroid state. It was of special interest to obtain data adequate to permit a definite conclusion regarding the relation of basal oxygen consumption to body size (surface area) and body composition (percent "cell mass") in normal, obese, and hyperthyroid women, since recently it has been suggested that basal oxygen consumption is more closely related to "cell mass" than to surface area or other factors.

Groups of young, aged, normal and obese, and hyperthyroid women were exposed to environments of 76° F. 30 percent relative humidity (R.H.) (3 hours), 63.4° F., 30 percent R.H. (3 hours) and 98.5° F. 66 percent R.H. (one hour). Body composition (as fat, "cell mass" and extracellular fluid) and basal oxygen consumption were determined also in groups of young and normal aged, obese, and hyperthyroid women.

The aged women tended to have more fat and less "cell mass" than the young women. Obese women had more fat and less extracellular fluid as percentages of body weight than did the normal women. With increasing weight above normal standards, there was found to be an increase in body fat, and decreases in the extracellular fluid and "cell mass" when expressed as percentages of body weight. From these changes, the composition of "weight gain tissue" or "obesity tissue" in women was estimated as 63 percent fat, 9.5 percent extracellular fluid, and 27.5 percent "cell mass".

Basal oxygen consumption was closely related to surface area, "lean body mass," and "cell mass," the closest relationship being to surface area. The rate of basal oxygen consumption per kilogram "cell mass" was found to be significantly lower in the obese women than in the normal young and aged women. For the euthyroid groups of young and aged normal and obese women, the basal rate of "cell mass" oxygen consumption was shown to be related both to body composition (as percent "cell mass") and to surface area. "Cell mass" oxygen consumption decreased curvilinearly with increasing surface area (assuming a constant proportion of "cell mass" to body weight and to decrease curvilinearly with increasing "cell mass" as percent of body weight (assuming a constant surface area). From these data on euthyroid women, a regression equation was derived which predicted rates of "cell mass" oxygen consumption for body size (surface area) and body composition (percent "cell mass"). The observed rates of "cell mass" oxygen consumption of hyperthyroid women were elevated above the predicted values by a greater percent than were their percent elevations of BMR as determined routinely.

Exposure to a comfortable environment indicated no difference in the response of young and aged normal and obese women. Hyperthyroid women had elevated mean skin temperatures and rates of evaporative water loss.

Exposure to a cooling environment revealed body cooling in all four groups of women. Despite a clear need for conservation of body heat in the cooling environment, a decrease in mean skin temperature below that of the normal women was not found in the obese women. Thus, there is no evidence that an increased subcutaneous layer of fat provides an insulating effect against heat loss. In the cool environment, the hyperthyroid women continued to have elevated mean skin temperatures and rates of water loss twice that of normal women. That this pattern of heat loss exists in a cooling environment, suggests that these effects may be concomitants of the hyperthyroid state which do not necessarily result from excess heat production.

Exposure to a hot room was tolerated well by all of the young and aged normal and obese women and the majority of hyperthyroid women. Some hyperthyroid women were unable to tolerate the hot environment, as could be expected because of their greater heat production.

Rates of both basal heat production and heat loss are closely related to surface area in young and aged normal and obese women despite differences in body composition. The same relationship exists in hyperthyroid women, but at a higher level. Surface area remains an important and reliable parameter in studies of heat regulation of the body.

128 pages. \$1.60. MicA54-3146

THE EFFECT OF GROWTH HORMONE ON THE RENAL FUNCTION AND ELECTROLYTE EXCRETION IN INTACT AND HYPOPHYSECTOMIZED FEMALE RATS

(Publication No. 10,073)

Monroe S. Glitzer, Sc. D.
Syracuse University, 1954

The primary purpose of this project was to study the effect of growth hormone in intact, seven and thirty day hypophysectomized female rats weighing from 160 to 200 grams. Graded doses of Armour's growth hormone (Lot. #R491024, equivalent to 50 mg. growth hormone in terms of standard preparation 22KR2) were administered for five days prior to the testing period to determine which dose had the best reparative effect upon the depressed renal functions of the hypophysectomized rats. The animals were obtained from the Hormone Assay Laboratories within 48 hours of the operation and in no instance were they used before the seventh day. The basic diet of Big Red dog chow was given. All animals were kept in a constant temperature room at 80°F. and allowed water *ad libitum*.

None of the dosages of growth hormone employed increased the GFR or RPF of intact rats. Growth hormone, at the levels employed, did not return the depressed GFR or RPF of hypophysectomized rats to pre-operative levels or above. The 2.0 mg./kg. dose had the greatest reparative effect upon the GFR of both the 7 and 30 day hypophysectomized rats. The hormone exhibited a greater effect upon RPF than GFR. The 2.0 and 4.0 mg./kg. doses caused the largest increases of the depressed RPF in the 7 day operated animals. In the 30 day group, all hormone doses had a similar elevating effect.

The kidney/body weight ratios of intact and hypophysectomized rats were not increased by hormone treatment. The renal effects observed were probably due to an increased renal functional activity rather than an increased kidney mass. The adrenal/body weight ratios of intact rats were not altered by growth hormone. The ratios decreased in the 7 day hypophysectomized rats and declined to a still lower level in the 30 day operated rats. Growth hormone did not elevate these depressed levels. It is concluded that a possible ACTH contaminant of this growth hormone, which might have affected the GFR and RPF, was not present.

The hormone did not increase the ability of either intact or hypophysectomized rats to excrete an orally administered water load. Diuretic tests indicated that there was no contaminant present in the hormone.

With one exception, the hormone had no effect upon the electrolyte excretion of either intact or hypophysectomized rats. At this time no explanation can be given for the natriuretic effect of the 4.0 mg./kg. growth hormone dose in the 30 day operated group.

53 pages. \$1.00. MicA54-3147

**CIRCULATORY FACTORS INFLUENCING
EDEMA FORMATION DURING HYPOXEMIC
PERFUSION OF ISOLATED RAT HINDLIMBS**

(Publication No. 9601)

Edith Di Pasquale Hendley, Ph. D.
University of Illinois,
Chicago Professional Colleges, 1954

The isolated hindlimbs of female rats were perfused with Ringer fluid containing twenty percent red cells and a low percentage of gelatin as the colloidal constituent. Severe hypoxemia (0 - 2 volumes percent oxygen) was achieved by thoroughly nitrogenating the fluid and mild hypoxemia (5 - 10 volumes percent) by oxygenating. The perfusion technique permitted the continuous recording of mean perfusion pressure, flow rate and weight of the hindlimbs, the latter being used to calculate the rate of edema formation during perfusion. The hemodynamic state of the vascular bed was determined from flow-pressure curves.

In a series of one hour perfusions at constant pressure over a range of 0 to 200 mm Hg there was a marked difference between severely and mildly hypoxemic perfusions. Compared with the latter there occurred a reduced vascular resistance to flow during severe hypoxemia along with a marked increase in tendency to form edema under increasing hydrostatic capillary pressures. Trypan blue, a colloidal dye of low diffusibility present in the perfusion fluid, was found to stain the tissues of the hindlimbs in a pattern that varied with the oxygen content. During severe hypoxemia the skeletal muscles were more deeply stained with dye than the cutaneous tissues of the preparation whereas the opposite relationship obtained during mild hypoxemia. This was taken as evidence that vascular shunting of fluid to the muscles at the expense of the skin occurred as the result of severe oxygen lack and/or that the skeletal muscle capillaries were rendered more permeable to trypan blue dye in the presence of severe hypoxemia.

In order to abolish the hemodynamic differences between the two groups, with a view toward determining whether capillary permeability was altered by oxygen deprivation, dibenzylamine, a potent beta-haloalkylamine, was infused during a second series of oxygenated and nitrogenated perfusions. Dibenzylamine successfully abolished the hemodynamic differences between the two groups, but was found to reduce to a marked degree the high rates of edema formation that were obtained in the untreated severely hypoxic limbs. The edema rates during oxygenated perfusion were only slightly increased in spite of the profound decrease in vascular resistance to flow, and thorough, diffuse, equalized staining of all of the tissues with dye. These results were interpreted to indicate that dibenzylamine prevented the increase in capillary permeability that is presumed to occur in severe oxygen lack.

Neo-antergan, a highly specific antihistaminic agent, was infused in another series of oxygenated and nitrogenated perfusions to determine whether histamine was responsible for the high edema rates

of anoxemic perfusion, and whether histamine blockade was responsible for the protective action of dibenzylamine. It was found that neo-antergan had the same protective action as dibenzylamine despite the marked reduction of vascular resistance to flow. However, neo-antergan was slightly less effective than dibenzylamine. The protective effects of these agents were not correlated with their specific blocking properties.

The evidence suggests that neo-antergan and dibenzylamine possess the ability to prevent an increased capillary permeability during severe hypoxemic perfusion under the conditions of this investigation, and that the hindlimbs provided with an oxygen content of more than five volumes percent do not exhibit changes attributable to an increase in capillary permeability.

148 pages. \$1.85. MicA54-3148

**IRON FROM GASTROINTESTINAL SOURCES
EXCRETED IN THE FECES OF
HUMAN SUBJECTS**

(Publication No. 9755)

Ruth Louise Ingalls, Ph. D.
Cornell University, 1954

Young women were given diets containing 1.03, 2.15 and 3.22 mg of iron during three 8-day periods respectively. The iron in the food and feces and the nitrogen in the food, feces and urine were determined. The amount of iron in the feces from gastrointestinal sources was calculated by two methods: (1) A regression of the values for fecal-iron on food-iron was extended to zero. The calculated value for gastrointestinal iron in the feces at zero intake was 0.17 mg. (2) The percentage absorption at which the gastrointestinal iron was the most constant for the three levels of intake was determined. By this calculation, the absorption for the three intakes was postulated to be between 18 and 25 percent and the value for gastrointestinal iron then laid between 0.12 and 0.27 mg. By either method of calculation, the mean value for daily gastrointestinal iron in the feces approximated 0.2 mg. The mean protein intake for the three diets was 59, 74 and 81 gm respectively. The amount of nitrogen retained by individuals reflected the protein intake of the subject previous to the experimental period.

43 pages. \$1.00. MicA54-3149

STUDIES ON TOTAL AND FRACTIONAL CARDIAC GLYCOGEN

(Publication No. 9190)

Arthur West Merrick, Jr., Ph. D.
University of Missouri, 1954

Total cardiac glycogen was analyzed in sixteen species of normal animals representing the Classes Pisces, Amphibia, Reptilia, Aves, and Mammalia. The highest value observed was in the common white sucker (*Catostomus commersonnii commersonnii*) which had a mean value of 2645 mgs/100 grams of heart tissue. This is the highest value yet reported for any vertebrate. With few exceptions the poikilothermic animals have a higher concentration of glycogen in the heart than homiothermic animals. This may be correlated with heart rate which is considerably slower in the cold-blooded animals. High total cardiac glycogen in the cold-blooded groups may also be correlated with conditions of potential anoxia to which these animals are frequently exposed. To adequately meet these anoxic situations a high glycogen reserve must be maintained within the auricular and ventricular myocardium. More fluctuation and variation is seen in the poikilothermic animals than in the warm-blooded groups. Factors responsible for this variability may be seasonal, environmental, nutritional, and metabolic. Activity of the animal may similarly account for some variation.

Lyoglycogen and desmoglycogen fractions of cardiac muscle were determined in seven species of normal animals and in dogs subjected to various forms of anoxia or anoxemia. The terms lyoglycogen and desmoglycogen were originated by Willstätter and Rhodewald (1934) and indicate free or loose glycogen and bound (presumably to protein) glycogen respectively. In these series of experiments total glycogen was obtained by the method of Seifter, Dayton, Novic, and Muntwyler (1950). The procedure of Bloom, Lewis, Schumpert, and Shen (1951) for extraction of lyoglycogen was used. Desmoglycogen values were determined by subtracting the free form from the total. The results obtained from the seven species of normal animals suggest the percentage of lyoglycogen increases as the total concentration is increased. One hundred per cent of the total glycogen (2403 mgs/100 grams) in the goldfish heart is in the free state while less than 19 per cent of the total (90 mgs/100 grams) in the mouse heart is in this form. It may be that the less resistant the animal is to anoxia the more bound glycogen is to be found in the heart. Lyoglycogen forms 86 per cent of the total in the control dog heart but is decreased to 31 per cent in the heart of the anoxic dog; desmoglycogen was correspondingly increased in the experimental animal. This suggests a conversion of the free fraction to the more complex, protein-bound form in which state it is utilized in the metabolic mechanisms leading to glycolysis. These fractions were also determined in excised dog hearts in order to confirm or contradict the results observed in the heart of the anoxic animal. There is an early tendency for the glycogen fractions to follow the previously

described anoxic pattern. Between one and seven and one-half hours after removal of the heart however, the trend is irreversibly changed; lyoglycogen increases and desmoglycogen decreases. Hypotheses are offered in explanation of these findings.

The cardiac glycogen fractions of dogs subjected to coronary occlusion were determined in the normal, border, and infarct zones. Total glycogen decreased in the latter two areas and desmoglycogen increased in the border zone. This substantiates the results obtained in the ischemic heart of the anoxic dog and in the early analysis of the excised dog heart. The electrocardiographic pattern during this coronary occlusion episode is presented and is essentially typical. Gross changes in the heart indicate a hemorrhagic condition at the infarct. The significance of lyoglycogen and desmoglycogen is still unknown but results obtained by the method of Bloom, Lewis, Schumpert, and Shen (1951) are constant and reproducible with the same tissue and same species of animal. These two integrants appear to be true physiological entities.

209 pages. \$2.61. MicA54-3150

ANTAGONISM OF EMULSIFIED FAT TO BARBITURATE DEPRESSION

(Publication No. 9196)

Robert Lee Russell, Ph. D.
University of Missouri, 1954

As it has been known for some time that certain of the barbiturates leave the blood stream for fat depots, an attempt was made to determine whether liquid fat added intraperitoneally or intravenously would alter the duration of the effect of the barbiturate in mammals.

First, in order to determine whether barbiturates would leave brain tissue in favor of liquid fat, rat cerebral cortex slices, placed in a Warburg apparatus, were subjected to the depressing effects of pentobarbital (20 mgm %) and thiopental sodium (100 mgm %). If liquid fat in the form of corn oil or corn oil emulsified with Asolectin (soybean phosphatides) were added to the pentobarbital-depressed tissue, the inhibited QO_2 was found to be alleviated. The emulsified corn oil stabilized with Asolectin was also found to alleviate the depression of oxygen uptake by thiopental.

Different emulsifiers were seen to have opposite effects on the oxygen uptake. Whereas acacia caused a depression of normal oxygen consumption of brain slices, the presence of Asolectin was found to produce an increase.

A temporary dispersion of liquid fat in saline injected intraperitoneally 20 to 25 minutes after the rat had been injected with pentobarbital sodium (40 mgm/kg) resulted in a significantly shortened duration of anesthesia as compared to controls receiving an equal volume of saline. The presence of acacia was found to reverse this effect.

Corn oil emulsified with Asolectin given intracardially (1 mgm of oil/gm) in rats was seen to shorten the duration of thiopental anesthesia. When this preparation was given intravenously in the same dosage to dogs, the duration of pentobarbital anesthesia was longer in the fat-infused animals than in the controls. This is not explained.

Lastly, a preparation of a corn oil emulsion that is nontoxic (intravenously) to dogs is described.

133 pages. \$1.66. MicA54-3151

VARIATIONS OF EXCITABILITY IN THE CENTRAL NERVOUS SYSTEM OF THE CRAYFISH

(Publication No. 9143)

Charles Eugene Smith, Jr., Ph. D.
University of Illinois, 1954

Measurements were made of the time required for conduction of nerve impulses arising from tactile sense organs at the base of hairs on the border of one uropod through the sixth abdominal ganglion of the crayfish *Cambarus virilis* and *C. propinquus*. The measurements of conduction time were plotted as distributions for each animal and found to vary over a range from 1.5 milliseconds to 7.5 milliseconds, of which about 1.0 millisecond was extra-ganglionic conduction time.

No significant variation of conduction times was found when the frequency of input was varied from 0.25 cycles per second through 1.0 cycles to 4.0 cycles.

Faradic stimulation at 10 cycles per second and supraliminal intensity had no effect on conduction time when applied to the inter-ganglionic connective for ten seconds. When applied for thirty seconds, however, this stimulation was followed by reduced conduction times as measured in single elements and the reduction persisted for about two minutes after the end of stimulation.

Faradic stimulation at 10 cycles per second and supraliminal intensity was applied to one circumesophageal connective of the crayfish. Following the end of stimulation, a spontaneously-active fiber was found to fire at a declining frequency for many seconds. The initial rate and the duration of firing was found to vary directly as the duration of the faradic stimulation; 5 seconds stimulation had no effect, while 15 seconds stimulation was followed by discharge for about 30 seconds.

Both circumesophageal connectives were found to respond to mechanical stimulation of an antenna of the crayfish. Faradic stimulation of one connective was followed by a reduction in that connective of the number of responses to a standard mechanical stimulus applied to one antenna, while the contralateral connective showed an increase in response as measured in multiple elements.

The data were concluded to be evidence for plurisynaptic paths through the sixth abdominal ganglion,

susceptible of variation in number of synapses and duration of synaptic delays under the influence of fluctuating spontaneous activity of interneurons subliminally effective in altering the excitability of the efferent neurons of the ganglion. A hypothetical neural circuit derived in part from Forbes and Lorente de No was proposed as a structural basis for the phenomena observed.

128 pages. \$1.60. MicA54-3152

THE BIOLOGICALLY EFFECTIVE ELECTRIC CURRENT DISTRIBUTION IN RANA PIPIENS EGGS RESULTING FROM APPLIED CIRCULARLY POLARIZED ELECTRIC CURRENTS

(Publication No. 9150)

Richard Norman Stearns, Ph. D.
University of Illinois, 1954

Developing *Rana pipiens* eggs were exposed to elliptically polarized electric currents, the frequency of rotation of the current vector varying between zero and six thousand cycles per second. This type of electric current pattern was used to eliminate membrane polarization effects. The eggs were in the field for ten minutes at different stages of development, and visible damage was assayed immediately under a dissecting microscope. Changes in developmental pattern were followed in whole embryos and in histological sections. The distribution of events arising when eggs are treated between 0.25 and 5.0 times threshold (for visible damage) at different developmental stages are as follows:

- 1) The damage was mainly restricted to the interfaces between cells.
- 2) This damage pattern did not result from a corresponding sensitivity pattern since the percent of eggs which showed visible damage restricted solely to the interfaces at the 2 cell, 4 cell, and 8 cell stages were 13%, 55%, and 87%, respectively, with the voltage range employed in these experiments.
- 3) The percent mortality decreased when eggs were treated at stages with greater cell numbers.
- 4) The percent of eggs which cleaved but did not differentiate was low when treated before first cleavage, rose sharply at the 2 cell stage and declined with a slope approximately like that of the mortality curve.
- 5) The percent of eggs where only the vegetal half was destroyed (called animal-caps) was similarly related to cell number.
- 6) Alteration in developmental pattern was low before first cleavage, rose sharply at the 2 cell stage, declined with increased cleavage number, and rose again at approximately mid-cleavage and again decreased between small yolk-plug and tailbud stages.

These results are taken to indicate that the biologically effective current flow through the embryo is essentially an extracellular current (an ionic current as indicated by frequency-threshold curves).

The significance of this type of current distribution is discussed in terms of a proposed electrical model which is designed to represent a generalized multicellular organism. The significance of bioelectric potentials in morphogenesis is analyzed critically in terms of the electric model.

The embryological findings indicated that gross

geometry may play an important part in both histogenesis and organogenesis. Preliminary evidence is also presented which suggests that the movements made by a given blastula cell eventually determines its differentiation fate.

112 pages. \$1.40. MicA54-3153

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

THE ROLE OF THE UNITED STATES SUPREME COURT IN THE SETTLEMENT OF INTER-SOVEREIGN DISPUTES

(Publication No. 10,071)

Donald William Flaherty, Ph. D.
Syracuse University, 1954

This thesis is a study of the original jurisdiction of the United States Supreme Court where the litigants are states or a state and the United States. From the beginning of the English settlements in North America there were boundary disputes between the colonies. Some boundary controversies were settled by the parties to the conflict. Other boundary controversies were settled by appeal to English authority. Under Article IX of the Articles of Confederation, the colonies-become-states by general contractual agreement agreed for the settlement of boundary or other conflicts by commissioners or judges chosen by Congress. The difficulties of ad hoc settlements were substantial, and with the new federal form of government there emerged judicial jurisdiction over boundary conflicts and other controversies between states. Inasmuch as there was no substantive law to be applied to the relations in question, the role of the United States Supreme Court became essentially that of prestige arbitrator.

At first the states were reluctant to accept the jurisdiction of the new court, but in a century and a half the Supreme Court clearly established its jurisdiction over controversies between two or more states. The change in attitude on the part of the states is partially attributable to changing attitudes concerning state and union, to habit, and to methods used by the court. States being different from individuals, the Supreme Court considers this type of case in an untechnical spirit without reference to objections as to multifariousness, laches, and the like.

In the exercise of its original jurisdiction, the Supreme Court makes both procedural and substantive law. In the beginning the court itself first heard all of the evidence in controversies between states. But it soon developed the procedure of the use of special masters to take testimony and report to the court. Having granted some of its masters considerable

discretion, the Supreme Court has ordinarily, but not always, upheld their work.

In the absence of specific constitutional directives, the Supreme Court has had to establish standards in some of the cases of this type that have come before it. Some of the major sources of the substantive law that is applied are the value systems of the individual justices, the facts of the instant case, the constitutional and legal framework in which the court works, the current climate of opinion, and the rules of the game of the judiciary. Use is made by the court of the legal device of analogy. In the analogy of diminution the state is compared with an individual living within a state, and the rule applied by the state to the individual is, in turn, applied by the court to the state. In the companion analogy of accretion the quasi-sovereign state is compared to the fully-sovereign nation-state, and the rules developed in international law for relations between nation-states are applied by the court to certain relations between states in the American Union.

At the beginning of the Republic a Federalist court aimed a blow at the quasi-sovereign states that felled not the states but resulted in a rapid amending of the Constitution in the states' favor. Since that time the Supreme Court has been relatively cautious in its relations with its co-sovereigns, but has used mild sanctions against states to secure their cooperation.

In addition to a study of the various areas previously mentioned, the thesis contains as appendices a chronological list of inter-sovereign disputes before the United States Supreme Court, a classified list of inter-state disputes before the court, and a classified list of federal-state disputes before the court. There is also an annotated, classified bibliography.

302 pages. \$3.78. MicA54-3154

THE CONSTITUTIONAL DOCTRINES OF
MR. JUSTICE ROBERT H. JACKSON

(Publication No. 9802)

Robert Julius Steamer, Ph. D.
Cornell University, 1954

Robert Houghwout Jackson, in 1941, became the 87th appointee to the Supreme Court of the United States. His service as an Associate Justice was interrupted during the 1945-46 term when, at the request of President Truman, he served as Representative of the United States and its Chief of Counsel in preparing and prosecuting the charges of atrocities and war crimes against the leaders of the European Axis powers. In this unprecedented international criminal trial, Jackson helped to break new ground in international law.

From a reading of Justice Jackson's judicial opinions, it seems fair to conclude that he adheres to no absolutes, to no rigid concepts. In cases involving alleged violations of civil rights, he would permit no interference by government, state or federal, with a man's conscience, beliefs, or thoughts; but overt acts of expression which interfere with the privacy of others, which insult the beliefs of others, or which threaten the general peace, Jackson would curb in the name of order. In cases involving freedom of speech, Jackson has differed markedly with the Court in two important respects. First, he has defended what amounts to a discretionary pre-censorship by local officials of speeches to be made in the streets or other public places; second, he has expounded the theory that the due process clause of the Fourteenth Amendment does not precisely incorporate the provisions of the First Amendment. Consequently, Jackson views the First Amendment as being somewhat less severe in its restrictions on the states than on the federal government.

Jackson is reluctant to supervise too strictly the procedures of the courts of the states or of the committees of Congress. In cases in which a procedural unfairness is alleged, he cautiously avoids the basing of a decision solely on abstract principles of justice. He carefully reviews the circumstances of each case and attempts to determine whether there is in fact a miscarriage of justice. It is evident that Jackson fears most the police state and all that it entails - accusation, search, arrest, detention or punishment without a hearing - carried out by administrative police rather than by the traditional American processes of legal justice. These police-state methods Jackson would outlaw as a usurpation of individual rights.

In interpreting the enumerated powers of Congress, Justice Jackson's position is one of judicial self-restraint. He would construe congressional powers broadly, but would not impute to the legislature any intent which is not expressly stated in the statute or in its legislative history. As Jackson views the Supreme Court, its primary function is to adjudicate cases and controversies. In his opinion, the Court is not, and was never intended to be, a policy-making body. This does not mean that

Jackson disavows the American concept of judicial review, but rather that he will urge that a statute be invalidated only when Congress has clearly overreached its constitutional powers. Jackson has a healthy respect for *stare decisis* but he has not hesitated, on occasion, to overturn a precedent which he considers unsound. He would not adhere to precedent for precedent's sake.

Justice Jackson's over-all judicial philosophy manifests primarily a concern for orderly government. His opinions are remarkably free of any doctrinaire solutions, but rather, contain an abundance of practical wisdom and judicial objectivity. He is a zealous guardian of individual rights and a careful trustee of governmental power, and his cautious, restrained and orderly concept of judicial review allows for maximum political flexibility within the confines of the Constitution.

318 pages. \$3.98. MicA54-3155

POLITICAL SCIENCE,
INTERNATIONAL LAW AND RELATIONS

A STUDY OF THE UNITED STATES
NATIONAL COMMISSION FOR UNESCO

(Publication No. 10,169)

John Leo Cefkin, Ph. D.
Columbia University, 1954

Unesco's scheme of operations has been, in large part, based upon the establishment of a National Commission or national cooperating bodies in each of its Member States. Each Commission was conceived as a body inclusive of representatives of mass organizations, the qualified experts of the country and representatives of the government. Broadly stated, the functions assigned to the National Commission were implementation of Unesco's program and advising the government on Unesco's program. It was hoped that through these functions popular participation by broad masses of people would be secured.

The United States National Commission is a close approximation of the kind of Commission originally envisaged by the Organization. The unique feature of the United States Commission is to be found in the links it has established with organized groups representative of the people. The Commission consists of one hundred persons, sixty representing national organizations, fifteen representing state and local governments, fifteen selected at large and ten representing the federal government. The sixty national organization representatives are selected by their organizations while the other forty persons are appointed by the Secretary of State. The National Commission was thus designed to be representative of the educational, scientific and cultural interests of the American people. Popular interest and participation was also to be secured

through state and local councils and through biennial conferences of organizations on Unesco.

The popular character of the United States National Commission is in keeping with the American tradition of public interest and participation in governmental operations and the formulation of public policies. This tradition can be traced back to the citizen advisory committees constituted by several federal departments, to the use of citizen advisers and consultants at the Conference of Pan-American states at Chapultepec in 1945, and the United Nations Conference on International Organization in San Francisco.

The United States National Commission is concerned with matters relating to education, science and culture. It, therefore, follows that the Commission must draw heavily upon organized groups of intellectuals. As such the Commission inherits the functions of the American Committee on Intellectual Cooperation which was part of the League of Nations' Committee on Intellectual Cooperation.

The effectiveness of a National Commission may be judged on three bases.

- (1) Does it reach and involve people?
- (2) Does it render useful advice independent from governmental coercion?
- (3) Is it active in securing the implementation of Unesco's program?

The United States National Commission has had varying success in each of these three areas of endeavor. It has been most successful in providing useful advice and securing the acceptance of this advice by the government. In the period covered in this dissertation (1946-52) it has, to all intents and purposes, been the major source of program formulation.

The National Commission has tried to inform people. In the main, it has utilized its cooperating organizations as transmission belts with their memberships as the target of the Commission's appeal. The success of this approach has been limited because many of these organizations are themselves only moderately successful in communicating with their rank and file.

Securing implementation of Unesco's program has proved to be the most important shortcoming of the National Commission. In part, this has been due to its inability to motivate action at the "grass roots" level. In part it has been lack of consistent support in program implementation by the organizations represented in the National Commission.

The United States is a pluralist democracy in which people participate in different groups expressing their diverse interests. It is fitting that peoples concerned with intercultural cooperation should have democratically constituted organs for such cooperation. This function the National Commission does fulfill.

291 pages. \$3.64. MicA54-3156

AMERICAN SECURITY PROBLEMS IN THE FAR EAST, 1950-1952

(Publication No. 10,002)

Yu Nan Chang, Ph. D.
University of Washington, 1954

As an outgrowth of the geopolitical approach to international politics, collective security of today emphasizes the common defense. It has become a system that is global in scope and total in nature. Bi-polarization in international politics, the rise of the revolutionary trend, and the rapidly changing events in the Far East greatly influenced the development of Far Eastern affairs in the period from 1950 to 1952.

The signing of the Sino-Soviet Pact in February 1950 was the first step which brought about the change of power alignment in the Far East. The outbreak of the Korean War witnessed the combination of Soviet industrial power and Asiatic manpower. This, together with the Pact and its consequences, led indirectly to a military stalemate. Under these circumstances, neither group of belligerents felt free to undertake decisive military actions that might risk a third world war. The truce talks that followed throughout 1951 further revealed the nature of the military stalemate out of which a temporary settlement must be found as a substitute for military decisions.

The Indo-Chinese War, because of its international nature and its complicated features, also resulted in a military stalemate. While both sides - the French and the Vietminhs - were themselves unable to secure a settlement, military or otherwise, the war continued as a balanced engagement, with each side attempting to maintain the status quo. These Communist actions heightened America's concern for its security in the Far East. The immediate result was the sending of military and economic assistance to the strategically important countries in this area. Particularly, the United States committed itself to the support of the Republic of China's military forces on Formosa in order to prevent that Island from falling into the hands of the Communists. The signing of the Japanese Peace Treaty and of the United States-Japan Security Treaty recognized the possession by Japan of the right of individual and collective self-defense. These treaties also included Japan in a collective security system under which her defense was guaranteed.

The Communist political plot in the Far East as represented by the various Communist movements poses a dangerous threat. This conspiracy was directly supported by the Soviet Union by means of colonial revolution and two-front-war strategy. The American effort to strengthen the positions of these Far Eastern countries through military, economic, and other means was ultimately aimed at the maintenance of these governments and at increasing their role in the Western alliance. American economic assistance had been successful in supporting the military efforts of these nations and in securing other immediate effects. The launching of the American

truth campaign illustrated the need for a program counteracting the Communist ideological threat. However wide the campaign is in scope and new in its implementation, the degree to which the Far Eastern nations realize the Communist threat and the extent to which they share in the common defense scheme may explain the result of this campaign.

The implementation of this security policy during the designated period no doubt produced fruitful results. The improvement of the military situation in this area, together with the American determination to resist Communist aggression, resulted in a military stalemate, under which the Communist military threat was lessened. However, in pursuing American security during this period, military security had the primacy; other means – political, economic and ideological – were subordinated. Especially, since military strengthening is not always an asset, its liability must be counter-balanced by additional effort in other fields. A period of decision and adjustment following the stalemate may likely occur. Democracy also has to prove itself not only capable of securing peace in the military sphere but in other fields as well.

356 pages. \$4.45. MicA54-3157

GERMANY AND HER FUTURE: BRITISH OPINION AND POLICY, 1939-1947

(Publication No. 10,158)

Frederick Karl Schilling, Jr., Ph. D.
Indiana University, 1954

Part I concerns the period 1939-1945. With the coming of war a public controversy arose in Britain centering around the question of what was wrong with the Germans. At one extreme were those who answered in terms of the uniquely warlike nature of the German people. At the other were those who looked to environment, particularly to the economic environment of a fear-ridden German capitalism, to explain the rise of the Nazis and their drive to war. Many schemes emerged for the treatment of a defeated Germany. They tended to emphasize either physical control of Germany or cooperation with certain classes of the German people in changing Germany's economic and social structure. The attitude of the general public was determined, however, more by wartime events than by historical controversy.

During the war the government resisted pressure, emanating from those who believed in the value of hopeful propaganda directed to the German people, for a detailed statement of its peace aims. Nevertheless, speeches of the British leaders, the British stand in inter-Allied negotiations, and the agreements and pronouncements which resulted from those negotiations reveal that, with the exception of Churchill's momentary agreement to the Morgenthau plan in 1944, British policy aimed at an economically viable, though militarily impotent, Germany. British opposition to Soviet reparation demands marked the Yalta and Potsdam conferences. Britain's championship of

of French participation in the control of Germany and her success in surmounting American opposition to her occupation of the industrial northwest of Germany as her zone indicated a desire to balance a possible American withdrawal from Europe and insurance that Britain should play a major role in determining Germany's economic and political future. The Potsdam conference temporarily allayed fears that four-power cooperation in Germany would not materialize.

Part II treats British problems and policy on the zonal and four-power levels, as well as the reaction of opinion in Britain to the Labor government's German policy, 1945-1947. Starvation and economic stagnation in the British zone, coupled with Britain's impoverished condition and the emergence of great power competition in Germany, led to increasing Anglo-American cooperation. Although Bevin continued to press for treatment of Germany as an economic whole, with payment for German import requirements taking precedence over reparations, the convergence of British and American policy was reflected in the bizonal fusion agreement of December, 1946.

British Conservatives and Leftwing Laborites alike characterized Bevin's German policy as one of drift. Conservatives urged him to move more quickly in easing restrictions and conferring power on the Anglo-American zone Germans. The Labor Left wing, alarmed by the prospect of American domination, attacked Bevin for failing to follow a Socialist policy. But the complexity of the German situation rendered an already confused public apathetic, and political differences also operated to prevent a dangerous coalition of critics.

The chief limitations on British policy were economic and external. There was the need to try to work with the Soviet Union, or, failing that, to throw the blame for failure on that country and to seek balancing factors to Soviet power. There was the problem of reassuring France while resisting extreme French demands on Germany. From the viewpoint of either a balance of power or the internal economic situation it was necessary to work with the United States. The effect of the latter requirement on the independence of British policy is illustrated by the fate of Bevin's intention to socialize the basic industries of the Ruhr. Plans had scarcely been laid to vest ownership in the individual *Laender* when American opposition and the British financial crisis of August, 1947, caused their abandonment. By the Anglo-American agreement of December, 1947, the United States gained the dominant voice in bizonal policy in return for accepting the dollar liability of the area. Simultaneously, efforts to achieve four-power agreement ended with the failure of the London conference of the foreign ministers, and the way was opened for a further stage of development in Germany.

697 pages. \$8.72. MicA54-3158

AMERICANS AND CHINESE POLITICAL
PROBLEMS, 1912-1923

(Publication No. 10,018)

Urban George Whitaker, Jr., Ph. D.
University of Washington, 1954

After her defeat in the first Anglo-Chinese war China began a long series of attempts to defend herself against foreign encroachments. She first sought the secret of western power on a military and technological level, imitating western arms and steamships. After Chinese students began going abroad in the 1870's an institutional reform movement developed and, by the beginning of the twentieth century, China was actively seeking the secrets of the West in social and political institutions. Following the revolution in 1911 this receptivity became particularly strong toward American republicanism.

The American political tradition came to China in several ways during the first decade of the republic, some of it by example and some by explicit suggestion tailored to fit the Chinese situation. Perhaps most importantly it was carried by returned students. Some of them (e.g. Tang Shao-i, Wellington Koo, Wang Ch'ung-hui) had studied in America prior to the revolution; some (e.g. Hu Shih, Chiang Mon-lin) were studying here at the time of the revolution and returned before 1923 with new American ideas; and some (e.g. T. V. Soong, John C. H. Wu, Hsiao Kung-ch'uan) studied here during that period but were most important in China at a later date.

In China, college level study was almost entirely new in the republican period and was initially dominated by the Christian colleges, many of which did not graduate their first classes until after 1911. Mission school students and Chinese who came to the U. S. were approximately equal in numbers (a few hundred in 1911 and slightly over two-thousand in 1923); both came primarily from well-to-do families; and both concentrated on natural sciences and technical studies.

The new concentration on higher education and the emphasis on science study in the Christian colleges resulted in part from changes in the objectives of the overall mission enterprise. Early in the twentieth century the missions began shifting their emphasis toward a more elite economic and intellectual group in China and toward more concern for the practical affairs of daily life.

Other American groups also had their most extensive contacts with a Chinese intellectual elite. Sino-American organizations such as the college and business clubs were the first to admit Chinese to equal membership with foreigners in social organizations and afforded continuous intimate contact between Chinese and American scholars, businessmen and diplomatic personnel.

American journalism in China offered a strong example of the American tradition of free discussion and in addition was the major channel through which Americans' ideas about Chinese political problems were expressed.

A democratic Chinese republic was the eventual

goal of most American political suggestions. They often suggested specific plans aimed at achieving this goal through economic development, moral regeneration, political reorganization or education. But, the disintegration of the Chinese political situation in the early twenties underscored the necessity for developing the attitudes and social conditions prerequisite to political democracy. For this reason Americans generally concentrated their suggestions on education as a means of political progress. However, Sino-American educational contacts were dominated, both in the U. S. and in the Christian colleges in China, by natural science and technical studies. As a means of democratic political progress this science emphasis received its strongest support in the philosophy of John Dewey.

With Americans supporting the development of a democratic republic through education and with Sino-American educational contacts dominated by the natural sciences, the American offering in China had some elements which were politically neutral, useful alike to democrats and authoritarians. In the long range view, however, the strongest aspects of the American presentation were exclusively democratic. Whether their effect has been permanently neutralized or merely postponed by the continued dominance in China of authoritarian political regimes, only time can reveal.

426 pages. \$5.33. MicA54-3159

POLITICAL SCIENCE,
PUBLIC ADMINISTRATION

REGULATORY SYSTEMS
AND HOSPITAL STANDARDS

(Publication No. 8179)

Nelson Martin Robinson, Ph. D.
Syracuse University, 1954

As the frontiers of medical knowledge and understanding expanded in response to scientific progress, the resultant benefits to the general public tended to become increasingly dependent upon the availability of adequate hospital facilities within local communities. Institutional facilities, originally designed for the sick poor and which were frequently more concerned with spiritual rather than physical ills, gradually developed as the logical repository of the new techniques, equipment and skills that rapidly emerged from an advancing science. At the same time, the increasingly miraculous achievements of the research specialist and the practicing clinician served to focus popular attention upon the hospital as the predominant community facility for providing the general public with the results of an ever-expanding medical science. Thus, the modern hospital has evolved institutional facilities for concentrating, coordinating and integrating a multiplicity of expert scientific specialties, while the capabilities of modern

medicine have expanded to the point where the general public could assert a legitimate interest in the competence of institutional facilities undertaking to care for the sick and injured.

These two parallel developments have resulted in the emergence of two basic regulatory patterns, each seeking to influence the quality of hospital care: (1) the self-regulatory systems representative of private, voluntary efforts to control the evolutionary development of the modern hospital, and (2) governmental programs indicative of a growing recognition of the hospital as an institution 'affected with the public interest'. The former pattern has developed over the last thirty years, primarily under the auspices of the national professional associations intimately associated with the activities of the hospital, while the public regulatory systems have emerged relatively recently under the authority of the police power of the state governments.

This study undertakes to describe and evaluate the development and administration of these two distinct, but necessarily related, patterns of regulatory activity, with a view to clarifying the respective roles of both public and private agencies in their efforts to cope with the common problems of hospital standards. The subject matter also lends itself to a comparative analysis of the administrative processes of private and public regulatory systems.

Recognition of the need for a qualitative standard of hospital competence developed first within the ranks of organized medicine. The medical practitioner quite naturally tended to view the functioning of the modern hospital as within his professional bailiwick; consequently, he was quick to recognize a peculiarly professional self-interest in the development of a means whereby the inadequate or sub-standard institution might be identified. A challenge to the pre-emptive character of the initial control patterns developed with the emergence of medical specialty groups and with the growing professionalization within the field of hospital administration. Recently, a considerable portion of the hitherto uncoordinated and frequently antagonistic interests of the medical specialist, the hospital administrator and the medical profession generally has been apparently successfully merged in the formation of a single hospital accrediting agency.

In the formulation of standards of hospital competence the private regulatory systems developed rulemaking procedures which, while they never attempted to provide a mechanism to accommodate the contributions of all interested parties, nevertheless were reasonably successful in reflecting the crystallization of value patterns existent within the medical profession; an achievement evidenced by the widespread acceptance of these standards as valid criteria of hospital care. However, in addition to the limitations imposed upon the scope of these standards by the primarily medical orientation of the

rulemaking bodies, the enforcement processes suffered from a lack of attention on the one hand, and insufficient funds on the other. Thus, a considerable number of the nation's hospitals, especially those with a bed capacity of 25 or less, were not included within the stimulating environment of the self-regulatory programs.

Any regulatory program designed to safeguard the public interest in the quality of hospital care necessarily entails the construction of a standard of competence against which the institutional performance of the individual hospitals might be evaluated. Furthermore, the validity of such a standard would be dependent upon the extent to which it reflected the crystallization of values relative to the evaluation of the quality of hospital care; a process which, because of the inherently specialized nature of the subject matter, must initially emanate from professional practitioners closely associated with contemporary developments in the hospital. The formulation of public regulatory systems, based upon valid criteria, necessarily awaited the evolution of such criteria within the fabric of the private regulatory programs.

In most jurisdictions, state hospital licensure systems have been characterized by reliance upon an advisory hospital council which, by statutory authorization, guarantees specialized professional participation in the processes of administrative rulemaking and, in a few instances, adjudication. Enforcement procedures have generally relied primarily upon "educational-persuasive" techniques. Successful rulemaking requires the enunciation of standards which are valid in terms of existing knowledge and experience as a guide to the modification or alteration of the rule. It is highly significant that hospital licensure procedures have frequently provided a dual mechanism for facilitating this continuity in the administrative process: the advisory council and the give-and-take of the "educational-persuasive" techniques.

The peculiar competence of a hospital licensure program is to be found in its capacity for insuring observance of minimal safety levels of institutional performance on a state-wide basis. On the other hand, the private regulatory programs are representative of efforts to achieve optimum performance levels on a voluntary basis through appeals to the professional consciences of those responsible for the development of hospital policies. As the privately oriented programs seek to keep abreast of technological and scientific advancement and to urge individual hospitals to strive to meet higher standards of competence, the ground is thus well-prepared for the progressive step-by-step raising of the minimum performance levels required by public agencies in the interest of the public health, safety and welfare.

594 pages. \$7.43. MicA54-3160

PSYCHOLOGY

PSYCHOLOGY, GENERAL

COMPARATIVE FACTOR ANALYSES OF TWO CLERICAL CHECK LISTS

(Publication No. 9859)

Albert Bernard Chalupsky, Ph. D.
Purdue University, 1954

Major Professor: Ernest J. McCormick

A research problem in applied psychology which seeks to identify and compare functional areas of clerical activity through the application of factor analysis to two different types of job analysis check lists.

A check list of clerical knowledges and a check list of broad worker functions were independently used to analyze a representative sample of 192 office jobs. Item inter-correlations from each list were then factor analyzed.

The following four factors were identified as common to both lists: (a) Inventory and Stockkeeping, (b) Supervision, (c) Computation and Bookkeeping, (d) Communication and Public Relations. In addition, two factors were extracted from the knowledge list, Stenography-Typing, and Filing and General Clerical, both of which were subsumed under a single, more general factor of the check list of clerical functions.

Based upon the results of this study, it is suggested that the structure of clerical jobs identified here, plus the possible addition of automatic machine activity, be operationally evaluated as one basis for establishing a classification system for clerical jobs. The job variables which were found to characterize each factor should also be useful in future research in employee selection, training, and evaluation. The results further indicate that the development, application, and factor analysis of job analysis check lists appear to offer a worthwhile methodology for future research in job inter-relationships.

77 pages. \$1.00. MicA54-3161

A FACTOR ANALYSIS OF SELECTED JOB CHARACTERISTICS

(Publication No. 9865)

Robert Howard Finn, Ph. D.
Purdue University, 1954

Major Professor: E. J. McCormick

A research problem in industrial psychology designed to identify basic characteristics of jobs.

An R-technique principal components factor analysis was carried out involving 44 worker oriented variables that had been rated on 4000 jobs (these data were furnished by the U. S. Employment Service). The variables consisted of two (2) Training Time variables, twelve (12) Aptitude variables, six (6) Physical Demands variables, twelve (12) Temperament variables, five (5) Interest variables, and seven (7) Working Conditions variables. Each of 4000 jobs taken from the Dictionary of Occupational Titles was rated on these variables by U. S. Employment Service Analysts. The following factors were ultimately identified:

1. Mental and Educational Development vs. Adaptability to Routine
2. Adaptability to Precision Operations
3. Body Agility
4. Artistic Ability and Esthetic Appreciation
5. Manual Art Ability
6. Supervisory Ability vs. Adaptability to Routine
7. Clerical Ability vs. Heavy Manual Work

Factors 1 and 6 and Factors 2 and 5 are correlated.

It is suggested that the results of this study offer implications with respect to such activities as formulating job families, vocational guidance, job evaluation, and establishing standards for employee selection. 88 pages. \$1.10. MicA54-3162

THE DEVELOPMENT OF AN EMPIRICALLY VALIDATED PERSONALITY TEST EMPLOYING CONFIGURAL ANALYSIS FOR THE PREDICTION OF ACADEMIC ACHIEVEMENT

(Publication No. 10,025)

Benno G. Fricke, Ph. D.
University of Minnesota, 1954

The main problem of the thesis was to determine whether the unique type of item in The Opinion, Attitude and Interest Survey (OAIS) could be used to measure a construct posited as academic personality, and to determine the relationship of this psychological dimension to student achievement in college. A subsidiary problem, methodological in nature, was to compare two types of personality test items - the popular "true-false" item and the specially devised "configural" item.

Some Basic Concepts

Three relatively recent advances in the field of

psychological measurement which supplied important theoretical concepts basic to the configural item were critically reviewed. The configural item resulted largely from an assimilation and synthesis of the "partial-configural analysis" of Zubin and Meehl, the "intensity function" of Guttman, and the "compound-selective" item of Kuder and Jurgensen.

The Configural Item

The configural item used in the OAIIS consists of two statements linked in an unusual way. To each of the paired statements the test taker is asked to indicate "True" or "False;" then he is asked to indicate (in a third column on the answer sheet) with which one of his two answers he agrees most strongly. This third response reveals the intensity of his agreement with responses he has given to the content of the statements. From the two with which he agrees, he is required to select the one answer he prefers. Each item (consisting of statements (a) and (b) can be responded to in eight different ways: e.g., one person may indicate that both statements are "true" but that he feels most strongly about his "True" answer to the first statement (abbreviated as TaTbSa), another person like the first feels that both statements are "True" but unlike the first agrees most strongly with his "True" answer to the second statement (TaTbSb), and so on. Three responses are scored simultaneously.

Validation and Scale Construction

To determine whether the items in the OAIIS could be validated to predict academic achievement, an item analysis was made of the responses of 340 achieving and 473 non-achieving freshmen men in SLA. The inverse sine transformation test was used to test for differences in each of the configural and true-false response categories; discriminating configurations formed criterion scale C, and discriminating single responses formed criterion scale S. A measure of response set, scale Set T, was constructed by scoring the "True" response for those statements to which from 40 to 60 per cent of each criterion group marked "True." Set T was used as a suppressor variable; it was added to C and S to form two new scales, APC, and APS.

Cross-validation and Findings

To evaluate the usefulness of scores obtained from the OAIIS grade predictor scales the answer sheets of a cross-validation sample were scored. The answer sheets of 209 recent high school graduates who were tested with the OAIIS at least six weeks before the beginning of fall quarter classes, were used. When APC and APS were used in combination with HSR (transformed to probits), ACE, English, and OSPE, they were each found to contribute significantly to the prediction of fall quarter HPR. This is noteworthy since not one of 22 other studies describing the construction of a personality test demonstrated on a cross-validation sample that the personality test in combination with two or more predictors had a significant Beta weight in the multiple regression equation. The Beta weight of APC

(based on the configural item with response set controlled) was considerably larger (1.40 times) than the Beta weight of APS (based on the true-false item with response set controlled); the former was significant at the .001 level, whereas the latter was significant at the .02 level. In both equations ACE and English did not make a significant contribution when combined with HSR Probit, OSPE and the measure of the academic personality.

321 pages. \$4.01. MicA54-3163

SUPERVISORS' INCENTIVES AND JOB SATISFACTION

(Publication No. 9868)

Charles Rodrigue Giroux, Ph. D.
Purdue University, 1954

Major Professor: C. H. Lawske

A research in applied psychology which resulted in finding no correlation between job satisfaction scores and importance ratings on fifty-one items of a job satisfaction questionnaire.

Forty-eight companies were contacted and twenty agreed to cooperate in the first phase of this study. Content analyses were made of the material received from the supervisors of those companies, and a job satisfaction questionnaire of fifty-one items was constructed. All the items were also paired-compared on IBM cards.

Job satisfaction questionnaires and cards for paired-comparison ratings were sent to 576 supervisors of forty-eight companies in the second phase of the study. Supervisors were asked to answer the Job Satisfaction List and to rate the items on the cards according to their relative importance. The individual answer forms were returned by 339 supervisors and split into two groups.

A double item analysis was done on the primary group. Sixteen personal items and thirteen company items were retained. The reliabilities of the two keys were computed from the hold-out group. It was .91 for the personal items and .80 for the company items. The inter-correlation of the two sets of items was .49, which became .56 after a correction for attenuation. Therefore, the common variance was .24, and .31 after the correction.

The hold-out group was divided into four groups of satisfaction according to the answers to the sixteen personal items and the thirteen company items. The rankings derived from the importance ratings of the four groups were compared among them. This yielded a coefficient of concordance of .85. Such a high coefficient of agreement indicated that job satisfaction had no influence upon the importance ratings of the four groups. No correlation was found between job satisfaction scores and importance ratings.

The primary group and the hold-out group were pooled together in order to determine the relative

importance ratings and satisfaction scores of the fifty-one items. T scores were computed from those two sets of raw scores and used to develop a new index called index of gratification. This index provided a better means to the understanding of the complex motivational pattern of supervisors.

It was suggested that present motivation theories did not adequately explain human motivation.

76 pages. \$1.00. MicA54-3164

**MEASURING SUPERVISORS' AWARENESS
OF EMPLOYEE ATTITUDES:
A COMPARISON OF METHODS**

(Publication No. 9871)

Donald Richard Jones, Ph. D.
Purdue University, 1954

Major Professor: E. J. McCormick

An investigation of the relationship between supervisors' ability to predict group attitude and their ability to predict individual attitude.

Twenty-three supervisors in a research laboratory responded to a set of five-point response category, self-rating questions, which referred largely to themselves and their supervisory activity. One week later they predicted the attitude of their "group as a whole" to a collection of items from the first set. One week following this, they predicted the individual responses to the items of all, or a random sample, of the persons in their groups. Predictions were made for all persons in groups of less than 12 but for a random sample in groups exceeding this number. A week later, the personnel at the laboratories responded to an attitude questionnaire containing the items for which their responses, by group and by individual, had been previously predicted. The actual modes of each group were matched with the supervisors' predictions of group attitude. The responses of 105 persons were matched with 15 supervisors' predictions of their individual responses.

Measures of accuracy, for group and individual prediction, were calculated by squaring each difference between actual and predicted response, and taking the square root of the mean of these differences. The correlation between the supervisors' accuracy of group prediction and their mean accuracy of individual prediction is $+.54$. There was no significant difference between the accuracy of the supervisors' predictions of group attitude and their predictions of individual attitude.

The supervisors' self-ratings, and their predictions of group and individual attitude, were skewed in the favorable direction. However, the level of their predictions, both of group and individual attitude, was not significantly related to the accuracy of their predictions.

Accuracy measures were also calculated for each item, indicating the accuracy with which the supervisors, as a group, used the item to make

predictions. Item accuracy for group prediction and for individual prediction correlated $+.46$.

The items to which the employees responded more favorably, were more accurately predicted than those to which they responded less favorably. There is a correlation of $+.55$ between the accuracy measures of the items and the mean of the employee responses to the items.

Accuracy of prediction was correlated with variables in the supervisory situation, and in the personal history of the supervisors. Accuracy of individual prediction correlated $+.67$ with the rating of the supervisors by the employees.

Comparisons are made between the accuracy measure described, and accuracy indicated by the mean of the absolute differences between actual and predicted response. The two measures are highly correlated in this study.

92 pages. \$1.15. MicA54-3165

**A STUDY OF THE VOCATIONAL INTEREST
PROFILES OF USAF PERSONNEL OFFICERS
WITH AND WITHOUT FORMAL
PERSONNEL TRAINING**

(Publication No. 9851)

Ernest Leland McCollum, Ph. D.
University of Minnesota, 1954

Major Advisor: Donald G. Paterson

A study was made of the measured vocational interests of 594 Air Force personnel officers in three specialty levels, Director of Personnel (AFSC 0016), Personnel Staff Officer (AFSC 7316), and Personnel Officer (AFSC 7324). A personal data sheet and the Strong Vocational Interest Blank were used by the officers to record the information basic to the study.

Answers to seven specific questions were sought. These questions were:

(1) Are there significant and practical differences between the mean scores of USAF personnel officers and civilian personnel directors on the Personnel Director key of the Strong Vocational Interest Blank (SVIB)?

(2) Are there significant and practical differences between the vocational interest profiles of USAF personnel officers and personnel directors in civilian industry?

(3) Are there significant and practical differences between the vocational interests of Personnel Officers (AFSC 7324), Personnel Staff Officers (AFSC 7316), and Directors of Personnel (AFSC 0016)?

(4) From what in-services sources are USAF personnel officers drawn, and are there significant and practical differences between the vocational interests of individuals drawn from these source groupings?

(5) Are there significant and practical differences in vocational interests between officers of

the various ranks in the personnel field?

(6) Are there any significant and practical differences between the SVIB profiles of officers holding secondary and tertiary specialties in the personnel field and those having primary classifications in that field?

(7) Can personnel officers who meet certain objective qualifying criteria be distinguished in terms of the SVIB profile from those who do not?

The information secured from this investigation supported the following conclusions with reference to the questions above.

(1) USAF personnel officers score significantly lower on the Personnel Director key than civilian personnel directors. This difference in interest scores seemed to indicate a need for better selection and better training for Air Force personnel officers.

(2) Seven Strong Vocational Interest Blank keys differentiated best between the vocational interests of USAF personnel officers and personnel directors in business and industry. They were Farmer, Aviator, Policeman, Accountant, Office Manager, Banker, and Personnel Director.

(3) There were no significant differences among the vocational interests of USAF Directors of Personnel, Personnel Staff Officers, and Personnel Officers.

(4) Air Force personnel officers are drawn primarily from among graduates of the officers' candidate schools, the pilot training programs, and the university ROTC units. The OCS graduates have vocational interest profiles more nearly like civilian personnel directors than any other source group.

(5) There were no significant differences in vocational interests between officers of the various ranks in the personnel field.

(6) Officers holding secondary, and tertiary specialties as personnel officers scored no differently on the Strong Vocational Interest Blank from those officers performing a primary duty in the personnel field.

(7) Personnel officers who were more experienced when contrasted with those officers who were less experienced could be differentiated in terms of their Strong Vocational Interest profiles. This differentiation occurred primarily on the occupational keys composing Strong's occupational groups II, V, and VIII.

The contention supported by the findings of this investigation is that better selection and better training of USAF personnel officers would be needed to provide a professional group of officers similar to their counterparts in industry with respect to measured vocational interests.

129 pages. \$1.61. MicA54-3166

AN APPLICATION OF THE SEMANTIC DIFFERENTIAL TO THEMATIC APPERCEPTION TEST MATERIAL

(Publication No. 9126)

Margaret Pegram Reeves, Ph. D.
University of Illinois, 1954

An important aspect of contemporary research in language behavior has been the development of a device which allows the application of quantitative measuring techniques to certain aspects of meaning. This associative-scaling procedure has become known as the semantic differential. The semantic differential is not a specific test, but is rather a general procedure with wide application, and has been applied by Osgood, who developed it, and by a considerable number of his associates, to a variety of different problems. The present study concerns the application of one form of the semantic differential to a selected group of TAT pictures and its relationship to certain verbal material (brief story plots) pertaining to them.

The semantic differential procedure consists, briefly, of having the subject make associative judgments relating a sign to a set of continua defined by polar terms: in this study, of judging a TAT picture against a set of 7-point scales defined by polar adjectives.

The method used is similar to the single stimulus or absolute comparison method of psychophysics. Basic to the rationale of this study is the prediction that the strength of association as measured by the semantic differential is related to the strength of association as measured by other indices. Evidence to this effect has already been reported, and results of the present experiment add confirmation.

Three separate approaches to the problem, all based on this prediction, were made. (1) The first prediction was that within the total number of stories obtained for a given picture, subjects grouped together on the basis of having told stories containing similar themes would differ on the semantic differential from subjects who had told a different theme; that is, that subjects who had made similar verbal responses to the pictures would make similar responses on the semantic differential. A large proportion of significant differences were found when theme comparisons were made.

(2) The second was to test whether there were consistent variations indicated by the semantic differential when analyses were made across all pictures: specifically, whether there was a difference in semantic differential measures for those stories judged respectively ego-enhancing, frustrating, and threatening. The results showed a significant difference between gratifying and frustrating, and between gratifying and threatening, but not between frustrating and threatening.

(3) The third prediction was that the direction and degree of the deviation of a subject from the median for all subjects on the semantic differential would be related to the direction and degree of that subject's deviation from the median for all subjects

as measured by judgmental indices. Three different processes were applied for this purpose: a) semantic differential results were related to results obtained by computing a Discomfort-Relief Quotient for each subject; b) semantic differential results were related to results obtained from judgments of each story as to the positive (goodness, happiness, etc.) or negative (badness, sadness, etc.) characteristics of the situation described in the story; and c) semantic differential results were related to similar judgments made for each subject over all stories told by that subject. All these tests showed significant relationship between results on the semantic differential and judgmental ratings.

In addition to these more general analyses, it was attempted to see whether measures obtained from the semantic differential were discriminant among subjects who were judged to show characteristics of clinical significance in the stories which they told.

Implications this experiment has for the use of the semantic differential as an aid in test construction and as a diagnostic tool are discussed.

125 pages. \$1.56. MicA54-3167

A PATTERN ANALYSIS OF JOB REQUIREMENT FACTORS FOR A SAMPLE OF JOBS

(Publication No. 9894)

Charles Dare Scheips, Ph. D.
Purdue University, 1954

Major Professor: E. J. McCormick

A research problem in industrial psychology concerned with the classification of a sample of jobs on the basis of their pattern identity with respect to particular factor score levels. The factor scores were based on seven factors extracted from a prior factor analysis of 44 job requirements that dealt with training time, aptitudes, interests, temperaments, physical demands, and working conditions.

The patterns were derived for a sample of 4,000 jobs (analyzed by the U. S. Employment Service) by the following steps: 1) selection of the best factor predictors; 2) establishment of regression equations for the factor predictors selected; 3) derivation of factor scores by solution of the regression equations for the factors; 4) determination of cut-off points for the seven factor score distributions to establish score levels. These seven factor scores with their appropriate levels constitute the pattern for a job. The jobs were then classified on the basis of pattern identity.

The sample of 4,000 jobs was described by 115 out of a possible 192 patterns that could arise by permutations of the seven factor scores with their respective levels. Ten per cent of the patterns used accounted for 60 percent of the jobs in the sample.

The results of this study suggest that jobs tend to be described by a limited number of patterns in

terms of the variables used in this research. It is suggested that these results may be of value to the U. S. Employment Service in their studies of job classification.

64 pages. \$1.00. MicA54-3168

CUTANEOUS COMMUNICATION SYSTEMS UTILIZING MECHANICAL VIBRATION

(Publication No. 9664)

Paul Spector, Ph. D.
University of Virginia, 1954

The purpose of the present research program was to determine whether information can be communicated accurately by means of mechanical vibration of the skin. Although there are a number of cases on record of persons who have learned to receive most of their information tactually, experimental attempts to transmit speech directly to the skin have been largely unsuccessful.

A survey of previous studies concerned with discrimination of vibratory frequency and intensity indicates that the skin is substantially inferior to the ear in the perception of vibration. Therefore, information to be communicated by tactual vibration should be encoded in a manner which takes cognizance of the abilities and limitations of the skin.

No attempt was made to develop specific vibratory communication systems. Rather the dimensions of intensity, time, and spatial extent, which gave promise of providing vibratory cues, were explored with a view to constructing a communication system capable of transmitting a wide range of information. The dimensions of frequency and wave-form were not investigated since they could be expected to offer few cues.

In the first experiment the number of just noticeable differences of intensity between approximately 20 and 385 was determined. The relative difference limens were largest at low amplitudes, between 57% and 60% at about 20 and descended to approximately 15% above 150. Thirteen, fifteen, and sixteen j.n.d.'s, respectively, were found over this range for the three observers who participated in this study.

In the next experiment, subjects were asked to judge levels of amplitude in terms of numbers which were assigned the various levels in order to determine the number of intensities which could be identified in an absolute manner with 100% accuracy. The levels were separated by equal numbers of j.n.d.'s, as determined in the previous experiment.

Of the ten subjects who participated in the experiment, two could consistently identify without error five levels of intensity. Five could identify four levels, and three were able to identify three levels.

Just noticeable differences of duration were found from 0.1 second to 2.0 seconds for four subjects. Twenty-five j.n.d.'s were found for three subjects and twenty-six for one. The difference limens

ranged from 40% to 50% at 0.1 sec. to a mean of 9.5% at an average of 1.86 seconds.

In the experiment to determine the number of durations which could be identified without any errors, one subject was able to judge seven levels with an accuracy of 100%, one could identify 6 levels, two made no errors at five levels, four made none at four levels, and two could identify only three levels consistently.

A fifth experiment was undertaken to determine the number of loci of stimulation that could be identified accurately. The distance separating the vibrators was larger than the two-point limen for successive vibratory stimulation. Of ten subjects one was able to identify six places, five could identify five places and four made no errors in judging four places.

Another experiment was done to determine whether subjects can identify the diverse aspects of vibratory stimuli without error. Four vibrators were used and at each place three levels of intensity and three levels of duration were employed, thus, providing 36 combinations of duration, intensity, and place. Each stimulus was presented once and subjects reported its locus, duration, and intensity.

Of the four subjects participating one made no errors and the other three made one error each. By the addition of dimensions it was judged possible, then, to increase the number of alternative stimuli which can be accurately identified from maxima of six or seven when the dimensions were used singly to thirty-six when dimensions were combined.

The possibilities of developing practical vibratory communication systems are considered and further research is discussed.

85 pages. \$1.06. MicA54-3169

PSYCHOLOGY, CLINICAL

AN EXPERIMENTAL COMPARISON OF RELATIONSHIP-CENTERED AND PROBLEM-CENTERED COUNSELING

(Publication No. 10,051)

Herbert H. Coburn, Ed. D.
Wayne University, 1954

Problem. This research investigates the relationships between (1) client reactions to a first counseling interview, (2) three modes of counseling, and (3) three types of clients. The three modes of counseling are characterized as (1) relationship-centered, paternalistic, counselor-director; (2) relationship-centered, equalitarian, client-directed; and (3) problem-centered, equalitarian, counselor-directed. Certain categories of counselor behavior were found to be invariably classified as uniquely characteristic of each of the three modes. The three types of clients are those who have felt needs corresponding to one or another of these three categories of counselor behavior.

Subjects. Ninety student-teachers, ten for each experimental condition.

Procedure. The mode of counseling was varied through the use of role-playing techniques in which student-teachers, identifying with the client in his role, observed professional actors in standardized counseling situations. Instruments were developed for measuring the pertinent needs of clients. Comparison of the nine experimental conditions was made by obtaining scores on sixteen indices which referred to relevant experiences which clients had previously been shown to have in the initial phases of counseling. Data were treated by analysis of variance and covariance in 3 X 3 factorial design.

Results. Significant differences were obtained based upon both mode of counseling and type of subject. Subjects who received relationship-centered treatment scored higher on most indices regardless of their felt needs. Subjects whose felt needs characterized a preference for equalitarian counseling scored higher on most indices regardless of the mode of treatment they received.

Conclusions. Definite measurable and consistent differences are obtained in the reactions of clients of different types of needs to the same technique of counseling. Definite measurable and consistent differences are also obtained in the reactions of clients of the same needs to different techniques of counseling.

175 pages. \$2.19. MicA54-3170

AN EXPERIMENTAL INVESTIGATION OF THE MEANINGS OF UNDERSTANDING IN THE COUNSELING RELATIONSHIP

(Publication No. 10,054)

Augustus Hall Fenn, Ed. D.
Wayne University, 1954

Problem. This research investigates the relationships between (1) client reactions to a first counseling interview, (2) counselor techniques of demonstrating understanding, and (3) personality structure of clients. Counselor techniques varied on two major dimensions: (1) the focus of understanding on either (a) the client as a person, or (b) the external situation in which the client is involved; and (2) the type of understanding, as of either (a) an empathic, shared-feeling nature, or (b) a more cognitive, reasoned knowledge of the client or his problem. Clients varied on the dimension of centrality-peripherality; that is, the relative accessibility of the more inward and intimate aspects of the client's personality.

Subjects. Eighty student-teachers, ten for each experimental condition.

Procedure. Both the focus and type of understanding were varied through the use of role-playing

techniques in which student-teachers, identifying with the client in his role, observed professional actors in standardized counseling situations. Four such situations demonstrated (1) understanding of the person through empathy, (2) understanding of the person through knowledge, (3) understanding of the situation through empathy, and (4) understanding of the situation through knowledge. Instruments were developed for measuring centrality-peripherality of personality structure. Comparison of the eight experimental conditions was made by obtaining scores on sixteen indices which referred to relevant experiences which clients had previously been shown to have in the initial phases of counseling. Data were treated by analysis of variance and covariance in 2 X 2 X 2 factorial design.

Results. Significant differences were obtained based upon foci, types, personality structures, and the interactions of these factors. Subjects who received empathic understanding scored higher on most indices. The differences obtained between foci and between personality structures varied differentially according to the type of understanding and the particular index involved.

Conclusions. Definite measurable and consistent differences are obtained in the reactions of clients to different techniques used by counselors in demonstrating their "understanding."

191 pages. \$2.39. MicA54-3171

THE INFLUENCE OF CERTAIN MATERNAL ATTITUDES ON THE BEHAVIOR OF REJECTED CHILDREN

(Publication No. 9711)

Richard S. Greenbaum, Ph. D.
University of Florida, 1954

To investigate the effects of various philosophies of child-raising upon the behavior of maternally rejected children who were clinic referrals, fifty-nine cases were selected from a clinic population. These cases represented all the rejected children who were patients at a community clinic during a period of one year, and who met certain criteria. These criteria were selected to reduce variations in culture, socioeconomic status, intelligence, home environment and the type of pathology present. In all cases where a non-rejected sibling was available, he or she was placed in a control group. If more than one sibling was present, the one nearest to the clinic case in age and sex was chosen.

Maternal rejection of the clinic case was determined by agreement between three clinicians. Non-rejection of the sibling was determined by means of a rating scale filled out by two clinicians.

The philosophy of child-raising of the mother was ascertained by means of the Shoben Parent Attitude Scale, which yields scores on the amount of

possessiveness, dominance, and ignoring present in each mother.

The behavior of all the children was rated on a graphic scale by two clinicians and a teacher. Their behavior was rated on various continua: aggression-withdrawal with respect to relationships with peers, parents, and authoritarian figures other than parents; dependence-independence with respect to parents and authoritarian figures other than parents; and integration into a group of peers. The ratings yielded numerical scores which permitted statistical comparison between groups on the above factors.

The behavior of the rejected and non-rejected children was significantly different at the .02 Level of Confidence, as ascertained by the "t" test for all factors considered. The behavior of the rejected children was more extreme than that of their non-rejected siblings.

The relationship between the philosophies of child-raising of the mothers of rejected children and the behavior of their children yielded correlations that did not significantly vary from zero.

It was concluded that the presence of a maternal feeling of rejection toward children who are referred to a clinic is a major factor in the development of behavior pathology. It is further concluded that in these cases the maternal philosophy of child-raising does not have a significant effect on the behavior pattern of the children in terms of their aggression, dependence, and group integration.

102 pages. \$1.28. MicA54-3172

THE RELATIVE EFFECTIVENESS OF VARIED PATTERN ANALYSIS TECHNIQUES AS APPLIED TO NON-COGNITIVE DATA

(Publication No. 10,027)

Gerald Carl Helmstadter, Ph. D.
University of Minnesota, 1954

Major Advisor: K. E. Clark

The purpose of this study was to evaluate the effectiveness of suggested pattern analysis techniques in the function of classifying individuals into discrete categories, and to determine whether further empirical investigation of these methods was worthwhile. Pattern analysis was defined to mean any technique which attempts to assess the degree of similarity between two or more profiles, and the classification problem considered to be that which starts with profiles of homogeneous groups previously defined and utilizes the similarity indices for sorting a new heterogeneous pool of subjects into these groups.

The method involved the application to a set of artificial data of all those techniques which appeared to be neither algebraically identical with nor approximations to other techniques. Comparisons were then made of the success of classification with chance expectation, among the techniques, and with

the traditional procedures of linear discriminant function and subjective judgment.

The data used consisted of 270 geometric solids, of which one-third were spheres, one-third right circular cylinders, and one-third regular tetrahedrons. The original dimensions of these solids were arbitrarily chosen, and eight 'measurements' involving both discrete and continuous variables were made algebraically on each solid. To each of these measures an approximately normally distributed error component having a variance close to one-fifth that of the true measures, and an arbitrarily selected group bias was added, thus forming the 'raw scores' on eight predictor variables. A ninth predictor variable composed entirely of normally distributed error was then included to complete the data set.

The population was next divided into an experimental and an independent sample. Then, on the basis of constants derived from the experimental sample, the measures were made comparable by converting them into 'standard scores' having a mean of 50 and a standard deviation of 10. Reference profiles consisting of the mean standard scores for each group, and the requisite constants for the various techniques were then computed using only the experimental sample. Each technique was then used to classify the members of the independent sample.

The results of the application indicated that all of the methods except linear discriminant function classify better than would be expected by chance; and that the only significant differences among the methods were those between discriminant function and each of the others and between Zubin's rough estimate and each of the others except subjective judgment, product-moment correlation and the Cronbach-Gleser index with elevation removed.

On the basis of these results and within the limitations of this study it was concluded that:

1. Linear discriminant function should not be used without careful consideration as to its appropriateness for the data.
2. Insofar as data are analogous to that used in this study, where level was not of too great an importance, and the dispersion matrix differed from group to group,
 - a. It makes little difference in terms of accuracy of classification whether rank order correlation, product-moment correlation, intra-class correlation, Hathaway-Meehl CC', Cronbach-Gleser distance, Du Mas' X^2 , Cronbach-Gleser distance with elevation removed, Meehl's DI or subjective judgment is used.
 - b. Zubin's index, while less accurate than the other indices, can serve as a simple, adequate approximation.
 - c. Ordinary linear discriminant function should not be used.
3. An analysis of the data to determine why the discriminant function did not predict

successfully, and further empirical study of the effectiveness of these techniques under somewhat different conditions would be worth while.

134 pages. \$1.68. MicA54-3173

LEARNING THEORY AND THE PROBLEM OF THE SELF

(Publication No. 9083)

Malcolm Morris Helper, Ph. D.
University of Illinois, 1954

In this study, an attempt has been made to (1) provide a behavioristic theory of the self concept, (2) deduce an interlocking chain of hypotheses relating the self concept to parental reward on the one hand and to social adjustment on the other, (3) devise an instrument to assess these variables, and (4) test these deductions.

The self concept is conceived as a series of covert reactions which are associated with one's identity symbols (name, self-referring pronouns, etc.). Covert reactions are thought of as learned responses which may cue overt behavior, provide secondary reward, or arouse secondary drive, depending upon the conditions of their acquisition and arousal. It is postulated that the covert responses corresponding to an individual's identity symbols acquire great potentialities for cuing secondary reward and arousing secondary drives through continued association with social satisfaction and with social arousal of drives.

Consideration of the similarity between the present conception of the self and Hull's concept of the fractional anticipatory goal response led to the general hypothesis that self concepts act to integrate behavior sequences leading up to social satisfactions and leading away from social punishments. Association of both reward and punishment with aspects of the self concept involved in integrating a single sequence of social behavior should result in instability in that behavior.

Of 14 hypotheses derived from the theory, 8 deal with relationships of parental reward to characteristics of the child's self concept. Six deal with relationships among aspects of the child's self concept and his sociometric status.

To assess self concepts and to derive indicants of parental behavior toward the child, an instrument composed of 52 adjectival scales from personality and semantic factors was used. Subjects consisted of 76 junior high children and 106 of their parents. In all, 50 families were represented by both parents and one child. Cronbach and Gleser's method of profile comparison was applied.

Our findings failed to show that the child's ideal-self concept is more similar to the ideal-child concept held by his own parents than it is to that held by randomly-selected parents, or that, within the family, it is more similar to the ideal-child concept held by the mother than to that held by the father.

However, indicants of parental reward are related to similarity between boys' ideal-self concepts and their fathers' ideal-child concepts, and to similarity between boys' self-concepts and their concepts of their fathers. Furthermore, a high degree of similarity between boys' self concepts and their concepts of their fathers is associated with high sociometric status for the boys. This pattern of relationships does not appear for girls. Follow-up of this sex difference led to the finding that a high degree of parental reward for similarity to mothers is associated with low sociometric status for girls. No such relationship appears for amount of reward given to boys for similarity to father. This sex-difference deserves further study, and suggests among other things, that the peer group may play a different role in rewarding the self-responses of girls and boys.

Discrepancy between the parents in ideal-child concepts was found to be associated with instability over time of the child's ideal self-concept. This instability was found, in turn, to be associated with low sociometric status, for boys. A less consistent pattern was found for another presumed indicant of conflict in self-evaluation.

The partial success of the present study in predicting, from a consistent theoretical framework, relationships between aspects of the self-concept and both antecedent (parental) conditions and behavioral consequents (sociometric status) suggests that the method is promising.

136 pages. \$1.70. MicA54-3174

DIFFERENTIAL OUTCOMES OF COUNSELING WITH COLLEGE MEN

(Publication No. 10,028)

Donald Paul Hoyt, Ph. D.
University of Minnesota, 1954

Major Advisor: Donald G. Paterson

Relatively few researches in the area of counseling have concerned themselves with the question, "What types of techniques (and conditions) produce what kinds of results with what types of students?" It was this question that guided the present investigation.

Eleven different hypothesized outcomes of counseling were studied. Methods of measuring included situational tests (for three outcomes), follow-up interviews (for four outcomes), and client self-ratings (for four outcomes). Independent ratings were made by three different judges for the situational test and interview variables. The median inter-judge correlation was .63.

The relative effectiveness of two counseling methods (eclectic and Rogerian) and four counselors in dealing with students with two types of problems (vocational planning and social relations) was determined for each of the 11 criterion variables. The experimental design was a 2 x 2 x 4 factorial with

2 replicates. Statistical tools employed were the analysis of variance and, where appropriate, the analysis of covariance.

Subjects for the experiment were Arts College freshman men who had indicated by questionnaire and in a screening interview that they were interested in receiving counseling regarding either vocational planning or social relations problems. A total of 16 students in each problem area were chosen, and assigned by a random method to one of the four counselors and to one of the two methods.

Because eclectic counseling has not received the unambiguous definition provided client-centered, or Rogerian, counseling, a special effort to clarify its meaning was made. A questionnaire was sent to 110 counselors in 17 different college counseling centers. Those items on which a significant percentage of the eclectic counselors agreed were taken as the definition of a model of eclectic counseling.

For each variable, seven different null hypotheses were tested, three regarding the main effects and four regarding the interactions. All seven of these hypotheses were accepted for the variables of morale, planfulness, problem solving, affect toward others as persons, certainty of self-estimate, and self-understanding. Six of the seven hypotheses were accepted, and one rejected, for the variables of defensiveness, responsibility taking for others, satisfaction with self, appropriateness of certainty in terms of self-understanding, and change in the severity of specific problems. Thus the major finding of the study is that for most criterion variables, the nature of the client's problems, the counseling method employed, the particular counselor involved, or any combination of these three factors made little difference in terms of the degree to which the hypothesized outcomes were attained.

Three of the five hypotheses which were rejected concerned an interaction effect. In the case of defensiveness, one counselor was relatively more effective with vocational clients, while the other counselors were more effective with social relations clients. The relative effectiveness of the two counseling methods was found to be conditional upon the type of problem presented by the student for the variable of appropriateness of certainty in terms of self-understanding. For responsibility taking for others, the interaction effect between all three factors was significant, indicating the complex determinants of the degree to which this outcome was attained.

Only two of the hypotheses which were rejected concerned a main effect. Vocational clients expressed more satisfaction with themselves after counseling than did the social relations clients. Eclectic counseling was more effective than Rogerian counseling in reducing the severity of specific problems.

Implications were drawn in terms of the need for a theoretical framework by which counseling objectives and methods might more appropriately be derived.

227 pages. \$2.84. MicA54-3175

A THEORETICAL AND EXPERIMENTAL
CONSIDERATION OF THE RORSCHACH
MOVEMENT RESPONSE: ITS RELATION
TO THE NEUROPSYCHIATRIC PATIENT'S
ORIENTATION TO HIS PROBLEM

(Publication No. 9947)

Gerald Franklin King, Ph. D.
Michigan State College, 1954

In the interpretation of the human movement response (M) to his series of ink blots, Rorschach related it to intelligence, creativity, emotional stability, suggestibility, rapport, and empathy. A survey of the validation studies failed to provide consistent support for any of the interpretations posited by Rorschach. The purpose of this investigation was to redefine the meaning of M and to provide an empirical test of this new interpretation.

The area of interpersonal relationships was suggested as a fruitful frame of reference for this interpretation by some current theoretical orientations, as well as some research findings. After making a distinction between universal and collateral meanings, the following basic interpretation of M was offered: the ability in fantasy to project the self into time and space in the interpersonal sphere.

This basic interpretation of M was viewed as having certain implications for psychopathology. Specifically, the following four hypotheses were formulated in regard to the orientation of neuropsychiatric patients to their problems (illnesses):

1. The High-M producers will show a greater tendency to recognize their problems as involving disturbances in interpersonal relationships than the Low-M producers.

2. The High-M producers will show a greater tendency to project themselves backward in time in accounting for the origins of their problems than the Low-M producers.

3. The High-M producers will show a greater tendency to utilize interpersonal fantasy in coping with their problems than the Low-M producers.

4. The High-M producers will show a greater tendency to project themselves beyond their present problems into the future than the Low-M producers.

The principal instrument selected for obtaining the data to test the hypotheses was the controlled interview. An interview outline or schedule was constructed as a guide for the interviewers, who were systematically rotated. Within forty-eight hours of the interview, all subjects were administered the Rorschach and Wechsler-Bellevue Verbal Scale (Form I). The M response and the measurements derived from the interview were found to possess an adequate level of inter-rater and test-retest reliability.

The preliminary subjects consisted of one-hundred recently hospitalized functional neuropsychiatric patients. On the basis of Rorschach performance, High-M and Low-M groups, consisting of thirty subjects each, were selected. The criteria for the selection were three or more M for the High-M group and one or Zero M for the Low-M group.

The two groups were equated for age, education, intelligence, diagnostic status, cooperation, confusion, and nine Rorschach variables.

The results confirmed or strongly supported all the hypotheses.

In the discussion of the results, the following three aspects were emphasized:

(1) On the basis of the obtained relationships between M and the individual's orientation to his psychiatric illness, M could be an important variable for predicting behavior in psychotherapy.

(2) The interpretation of M that was formulated and the consequent empirical findings suggested that M could have important implications for the psychology of thinking.

(3) The methodology developed and employed in this investigation demonstrated that the controlled interview, by providing reliable measurements, can be a useful research instrument.

112 pages. \$1.40. MicA54-3176

CONDITIONING AND EXTINCTION OF
OPERANT VERBAL BEHAVIOR IN
NEUROPSYCHIATRIC HOSPITAL PATIENTS

(Publication No. 10,149)

Sandor Klein, Ph. D.
Indiana University, 1954

This study was designed to investigate the extinction of a conditioned verbal operant under three routines: (1) non-reinforcement, (2) counter-conditioning and (3) negative reinforcement. Two experiments were run successively.

In the first experiment one hundred neuropsychiatric patients were run in five equal groups. There were three experimental groups corresponding to the three routines. In addition two control groups were run, a conditioning-control group and an extinction control group.

The procedure consisted of: (1) obtaining an operant level (trials 1-20), (2) conditioning (trials 21-100) and (3) extinction (trials 101-180). Each subject, therefore, received 180 trials. Each trial consisted of the presentation of a stimulus card, to which the subject responded with a sentence. The sentence included a verb and one of six pronouns all of which were arranged on a three by five index card. Each stimulus card contained a different verb and the order in which the six pronouns were arranged was randomized.

During the operant trials all groups were treated alike and E made no response at any time. During the conditioning trials E responded by saying "good" to S's each sentence beginning with "I" or "We" (A₁ response class) in all but the conditioning-control group. This group received no reinforcement during the entire experiment. The differential treatment for the experimental groups was begun during extinction. In the non-reinforcement group E proceeded to withhold the previous reinforcement. In

the counter-conditioning group E began reinforcing the other four available personal pronouns (A_2 alternative response class) and at the same time withheld reinforcement from the previously reinforced A_1 responses. In the negative reinforcement group E responded to S's each A_1 response by saying "no-good". In the extinction control group conditioning was continued till the end of the experimental session.

The results showed, that the frequency of A_1 increased significantly during conditioning in all the conditioning groups. Following conditioning the A_1 response was extinguished in all three extinction groups. Differences were found between the three different methods of extinction, but only the two extreme groups the non-reinforcement group and the negative reinforcement group differed significantly. The correct contingency between the subject's response and the experimenter's behavior was verbalized by only one subject out of the total of 100.

The second experiment was designed to answer the following questions: (1) If the extinction period were prolonged would all three groups differ significantly? (2) Would an asymptote be reached by each of the three methods, and if so, would the asymptotes differ?

Thirty neuropsychiatric patients were run as subjects, in three equal groups for 280 trials. The procedure used was identical with the first experiment. Again both conditioning and extinction were obtained in all groups, and this time there were significant differences during extinction between the three methods used. Negative reinforcement led to fastest extinction, counter-conditioning was next, and non-reinforcement led to slowest extinction. In the non-reinforcement group the final level was reached approximately at the operant level, while in both other groups the final level was at a rate significantly lower than the initial operant level.

Comparisons with other studies were made and clinical implications were briefly discussed.

74 pages. \$1.00. MicA54-3177

A COMPARISON OF SCHIZOPHRENICS, CHILDREN, AND NORMAL ADULTS ON THEIR USE OF COLOR

(Publication No. 9935)

Max Lloyd Marshall, Ph. D.
Vanderbilt University, 1954

The purpose of the investigation was to study the behavior of schizophrenics, children, and a normal adult group in a uniform coloring task. The task consisted of three pages of drawings of well-known things, such as a frog, a carrot, a collection of fruit, etc. and one page which contained a checked pattern of an abstract nature. All subjects were instructed to color the drawings however they wished, and a standard box of 16 crayons was provided for each subject.

Six predictions were tested which were contained

within the hypotheses: (a) that normal subjects would color the objects more realistically than schizophrenic subjects, (b) that a group of young children would be found roughly comparable to the schizophrenic group with respect to realistic coloring, (c) that of two groups of children the older group would be found to color more nearly like the normal adult group than would the younger group, again with respect to the realism of coloring, (d) that for the checked pattern normals would tend to reorganize the pattern by making a color design within the formal design, whereas schizophrenics would not tend to do this, (e) that in this last respect the ability of children would be found comparable to that of the schizophrenic group, and (f) that the older of two groups of children would more nearly approach the behavior of normals in the coloring of the checked-pattern.

Five judges assisted in the establishment of criteria for the scoring of realistic colors in connection with the objects represented by the drawings.

The drawings contained twenty-one parts which were rated for realistic or unrealistic coloring in the 119 protocols. In addition, the checked-pattern was scored for the presence or absence of a design or design tendency, for each of the protocols.

The schizophrenic group consisted of 30 white, male patients of a veteran's neuropsychiatric hospital; the median age of the group was 31.4 years and the median educational attainment was 10 grades. The adult normal group consisted of 40 white, male ward attendants of a veteran's general medical and surgical hospital; the median age of this group was 34.6 years and the median educational attainment was 8.9 years. The children's groups consisted of one five-year-old group of 25, and one seven-year-old group of 24. Both boys and girls were used, both were from the same school, and each group was considered to be above average in intelligence.

Findings of the study revealed that in general the predictions contained in the hypotheses were confirmed: (a) Schizophrenics and normals differed in the extent to which they colored unrealistically; schizophrenics received a mean of 8.47 unrealistic scores per protocol and normals received a mean of 2.47 unrealistic scores per protocol ($P = .001$). (b) The difference between the 5-year-old group and the schizophrenic group was insignificant with respect to the tendency to color unrealistically. (c) The older group of children more nearly approached the normal adult group in respect to realistic coloring than did the younger group. (d) With respect to the coloring of the checked-pattern, normals tended to reorganize the pattern in terms of color, producing a design by means of the color, whereas schizophrenics produced color designs to a significantly lesser extent than did the normals. (e) Neither the 7-year-old group or the 5-year-old group differed significantly from the schizophrenics in the tendency to color a design into the checked-pattern, although the difference between the schizophrenics and 5-year-olds approached significance ($P = .10$). (f) The 7-year-old group more nearly approached the adult control group than did the 5-year-old group in the

tendency to color a design into the checked-pattern; however, the difference between 7-year-olds and schizophrenics was insignificant in this respect.

The findings of the study were discussed in their implications for regression. The findings were considered to be most aptly explained in terms of a general theory of behavioral regard for the relationship between objects and their attributes, and implications for future research along this line were considered.

106 pages. \$1.33. MicA54-3178

A CORRELATION OF AFFECTIVE STATES WITH THE USE OF COLOR ON THE MOSAIC TEST

(Publication No. 9876)

Anthony William Martin, Ph. D.
Purdue University, 1954

Major Professor: John Hadley

The relationship between reactivity to color and affective lability was studied by testing certain hypotheses from current color-affect theory concerning both psychotic and non-psychotic individuals. The hypotheses tested were: the greater the affective lability of an individual, the greater the stimulus value that environmental objects will have for that individual; the greater the affective lability of an individual, the greater his reactivity to color; the single colors have differential stimulus effects; individuals with greater affective lability have color preferences that are different from those of individuals who are less labile; the lesser reactivity to color in the affectively-inhibited individual is a phenomenon of exclusion rather than of physiological defect.

A colored and colorless Lowenfeld Mosaic set and Meyrowitz Pseudo-isochromatic Plates were administered to each subject. The subjects were 128 white females in four equal groups. Three hospitalized groups were designated by case history criteria and psychiatric consensus as respectively Psychotic Inhibited, Psychotic Labile and Non-psychotic Labile. A group of stable non-hospitalized women were designated a Normal group.

The results of this experiment suggest that with psychotic individuals, current color-affect theory is correct in stating that the greater the affective lability of the subject, the greater the stimulus value that environmental objects will have for that subject. It is also correct in holding that there is a simple, direct relationship with psychotic individuals between the amount of affective lability and the degree of reactivity to color.

With non-psychotic individuals, however, current color-affect theory is incorrect in stating the above relationships in such simple quantitative terms. Other facets of their performance indicate a relationship between affective lability and reactivity to color that is complex.

The single colors do have differential stimulus

effects. Individuals with greater affective lability, however, do not have a distribution of color preference that is different from that of less affectively labile individuals.

Finally, the lesser reactivity to color in the affectively inhibited individual was found to be a phenomenon of exclusion rather than of physiological inadequacy.

52 pages. \$1.00. MicA54-3179

PSYCHOMETRIC CORRELATES OF EMOTIONAL IMMATURITY

(Publication No. 9620)

John Sumner Pearson, Ph. D.
University of Minnesota, 1954

Major Advisor: Starke R. Hathaway

An investigation was undertaken to determine whether or not the term "emotional immaturity" had any essential "core" meaning as used by different authorities and to determine whether or not efforts to discriminate between persons termed "emotionally immature" and normals in general on the basis of responses to the Minnesota Multiphasic Personality Inventory would result in a significant addition to the techniques of the clinical psychologist.

Review of the literature indicated that the term "emotional immaturity" is used so narrowly as to be restricted to description of behavior seen in temper tantrums by some writers and so broadly as to be synonymous with emotional maladjustment by others with many gradations between. No one appears to have taken cognizance of this situation or to have made any effort to secure a uniform definition and usage.

An "age scale" for the MMPI based on items showing significant discrimination between younger and older normals utilized in the standardization groups for that test failed to show expected differences between psychiatric patients termed emotionally immature and normals matched for age.

Another approach comparing the item responses of several groups of patients termed emotionally immature with those of normal groups provided a scale of 48 items termed the "emotional immaturity" or "EE" scale. This scale with appropriate "K" correction for test-taking attitude discriminated well between groups of patients termed immature and normals. Other scales of the MMPI, notably "D" and "Pt" did about equally well, however, and "EE" was not effective in discriminating between "emotionally immature" patients and psychiatric patients in general.

The "EE" scale gave a considerable number of "false negatives," chiefly among patients diagnosed as psychopathic personalities. It appeared that the grouping of psychopaths markedly deficient in ability to experience anxiety and psychoneurotics with extreme anxiety under the heading of emotional immaturity introduced heterogeneity which reduced the

significance of the heading to a simple affirmation of emotional maladjustment.

A recommendation based on the conclusions from the study was that behavioral scientists and practitioners should cease using the term "emotional immaturity" since it is used to subsume such widely different kinds of behavior. It would appear profitable to devote research effort to the behavioral definition of terms such as "lacking in judgment," "ego-centric," and other terms frequently applied to persons who are also termed emotionally immature.

227 pages. \$2.84. MicA54-3180

A LEARNING THEORY PARADIGM FOR PERCEPTUAL VIGILANCE AND PERCEPTUAL DEFENSE PHENOMENA

(Publication No. 9124)

Allen Raskin, Ph. D.
University of Illinois, 1954

The purpose of this study has been to determine whether typical learning procedures could be utilized to establish response sets which would yield the type of perceptual measurements that have been called perceptual vigilance and defense. Perceptual vigilance has been inferred from the fact that with very brief exposures subjects (Ss) more often pick as "clearest" subjects to which they are emotionally sensitized. Perceptual defense has been inferred from the fact that with longer exposures Ss pick less often as "clearest" those same objects to which they have been emotionally sensitized. This experiment attempted to produce this combination of perceptual tendencies by training Ss first to see and then to avoid an object, and then to demonstrate the effects of the training on perceptual behavior. The experiment also attempted to produce by training another combination of perceptual tendencies, namely, an avoidance of an object for both brief and long exposures, and to demonstrate predicted effects of this alternative form of training on perceptual behavior.

Method

There were two experimental groups of 20 Ss, all of whom were male college students. Four figures were presented to the Ss in a cross pattern so that S could report position as Right, Left, Top or Bottom. In the training, conducted with an exposure of .007 sec., Group I was asked to name the figure opposite to the triangle (star, circle, or square). Group II was asked to name the position of any figure other than the triangle.

A Gerbrand's Tachistoscope with a specially constructed electronic timer was used in presenting the pattern of geometric figures. The time of the brief exposure was .002 sec; that of the longer exposure .135 sec.

The order of procedure for both groups was (1) a baseline series of 20 presentations at the .002 sec.

exposure; (2) a baseline series of 20 presentations at .135 sec.; (3) a training series carried to a criterion of nine of 10 correct responses with a shock of 170 milliamps at 150 volts for each wrong response; (4) a test series of 20 presentations of the .002 sec. exposure; (5) a second training-series carried again to the same criterion with the shock arrangement; and (6) a final test-series of 20 presentations at the .135-sec. exposure-time.

Results

The theory predicted that Ss trained to name the figure opposite to the triangle in the training series (Group I) would report the triangle as "clearest" of the four more often in the test series with brief exposure than in the baseline series, and that they would also report the triangle as "clearest" of the four figures less often in the test series with the longer exposures than in the baseline series. At the .002 sec. exposure the predicted result was obtained for 14 out of 20 Ss ($X^2=3.16$, $df=1$, $P=.04$). At the .135 sec. exposure the predicted result was obtained in 12 of the 20 Ss ($X^2=.86$, $df=1$, $P=.19$). The theory also predicted that both of these perceptual response tendencies should appear in the same individuals, namely, they should pick the triangle more often in the test series at the brief exposures but less often in the test series at the long exposures than in the respective baseline series. This prediction was confirmed in 11 of the 20 Ss ($X^2=8.86$, $df=1$, $P<.005$).

By way of showing that such training could be made to produce differential results, the theory also predicted that Ss trained to name and give the position of any figure but the triangle (Group II) would report the triangle as "clearest" less often in the test series after training than in the baseline series at both brief and longer exposure times. At the .002-sec. exposure the predicted result was obtained for 14 out of 20 Ss ($X^2=3.16$, $df=1$, $P=.04$); at the .135-sec. exposure it was obtained for 16 out of the 20 Ss ($X^2=7.55$, $df=1$, $P<.005$). The predicated combined results appeared in 12 of the 20 Ss ($X^2=12.20$, $df=1$, $P<.005$).

A third hypothesis stated that, through training, the initially conscious perceptual set would pass to an unconscious level and continue to influence behavior in the predicted manner. Twenty-one of the 23 Ss from the two groups who performed as predicted during the brief and long exposures reported no awareness of the influence of the learned perceptual set on their responses during the test series ($X^2=15.74$, $df=1$, $P<.005$).

64 pages. \$1.00. MicA54-3181

THE INFLUENCE OF VARIATIONS IN INSTRUCTIONS ON RORSCHACH REACTION TIME

(Publication No. 9704)

Milton Hugh Williams, Jr., Ph. D.
University of Nebraska, 1954

Adviser: Marshall R. Jones

The aim of this study was to investigate some problems involved in the use of reaction time to the cards of the Rorschach Psychodiagnostik. A review of the research on this topic revealed that much of it was unsystematic and marred by the use of inadequate statistical treatment.

Factors in the Rorschach situation which contributed to the variation of reaction time included the cards, the setting and instructions, the subject, the administrator, and personal interaction between the administrator and the subject. The hypotheses tested in this study were developed from analysis of past work with the rationale that reaction time influences could be made meaningful only if they were investigated under controlled conditions.

It was hypothesized that the reason for unclear results in prior studies was that subjects were not instructed in regard to their reaction time behavior and that the resultant individual variations were due to varying individual interpretations of the situation and the influence of different examiners as well as to personality differences between subjects.

In order to test the hypotheses of the study, four groups of 15 students each were tested. Two of the groups were composed of males and two of females. One group of each sex was administered the cards in the usual manner - without instructions regarding speed of response (free condition); the other group was specifically instructed to respond as quickly as possible (pressure condition).

Groups were selected for comparability in age, education, verbal intelligence, and cultural background. All tests were administered by the same examiner in the same setting with identical instructions within each group. Results could then be interpreted as being due to differences in instructions. The influence of order of presentation on reaction time was ruled out by presenting the cards to each subject in a different order.

The reaction time differences between instructions, sexes, cards, between achromatic and chromatic cards, and the interactions among these sources were tested in a repeated-measurements analysis of variance.

No reaction time differences were found between methods of instructions, sexes, or chromatic and achromatic cards. The only statistically significant difference was between the cards; this corroborated earlier findings by the writer.

Additional tests were made to see if pressure administration resulted in changes in other Rorschach scores from those obtained under free conditions. The scores tested were those found by other investigators to vary under pressure conditions. Form

quality ($F/\%$) was the only measure which was significantly different. It varied opposite to the hypothesized direction for one group and was probably a chance deviation.

The lack of group differences is explained as a function of the fact that such instructions did not create reaction tendencies strong enough to influence the subjects in an otherwise permissive situation. It is possible that the similarity of the groups also reflects an intra-examiner consistency implied by other findings that different examiners produce different results in similar populations.

Empirically the results imply that an individual examiner may create a consistent response tendency to the extent that striking differences in instructions do not markedly influence his subjects' test behavior. The results of this study cannot be generalized to other examiners or to other types of populations until further research is completed.

70 pages. \$1.00. MicA54-3182

PSYCHOLOGY, EXPERIMENTAL

A COMPARISON OF MONAURAL AND BINAURAL LISTENING IN THREE LEVELS OF AMBIENT NOISE

(Publication No. 9890)

Robert Clark Bilger, Ph. D.
Purdue University, 1954

Major Professor: I. M. Baker

The purpose of this investigation was to compare monaural and binaural speech reception in three levels of ambient noise under conditions selected to allow inference to actual listening situations.

Speech reception thresholds and the standard deviation of these thresholds were determined for four listening conditions (binaural, in phase; binaural, out of phase; monaural, wearing two phones; and monaural, wearing one phone) in three levels (55, 80, and 105 db) of an ambient noise whose spectrum was shaped to resemble that of conventional aircraft. Thirteen normal hearing adults were tested, each under all twelve conditions.

The data were analysed by analysis of variance technique. With respect to the speech reception threshold data, the average binaural speech reception threshold was found to be 1.2 db lower than the average monaural speech reception threshold. This result is consistent with the degree of binaural summation reported previously for unmatched ears. However, in the 105 db ambient noise level, the one phone monaural threshold was found not to be different from the average binaural threshold. The "interaural inhibition" in this case was attributed to spatial separation of the signal from the noise resulting

from intensity differences rather than to the phase differences reported in previous studies.

The standard deviations of the thresholds were found not to vary across noise levels. Threshold variability across noise levels has not been reported previously, but this result supports the previous conclusion that signal-to-noise ratio is the critical variable in the listening in noise situation. The binaural, out of phase, threshold was found to be more variable than the binaural, in phase, threshold. If this result is confirmed, the previous conclusion that binaural, out of phase, listening is superior for listening in high level noise will have to be revised.

91 pages. \$1.14. MicA54-3183

THE QUANTIFICATION OF DRIVE I: INCENTIVE VALUES OF FOOD AND WATER.

(Publication No. 9940)

Robert Harlan Davis, Ph. D.
Michigan State College, 1953

The present study was conducted in order to establish incentive values for food and water, and in an effort to determine the feasibility of quantifying the drive construct once such values were known.

A push-panel apparatus was constructed in which activity levels could be measured simultaneously with response amplitude and latency.

Thirty-six male, albino rats were divided into two major groups, both of which were subdivided again into three groups.

1. High Drive: (a) Large Food Reward
(b) Small Food Reward
(c) Medium Water Reward
2. Low Drive: (a) Large Food Reward
(b) Small Food Reward
(c) Medium Water Reward

Each of the 36 animals was habituated to the box, assigned to one of the subdivisions, trained to open the push-panel for either food or water, and then tested for a total of 40 trials, 20 trials under a high drive and 20 trials under a low drive. Half of the animals began their test series under a high drive and half began their test series under a low drive in order to counterbalance the trials. Activity level for six minutes before the exposure of the push-panel, and the latency and amplitude of each response was recorded. At the close of the test series, all animals were extinguished under either high drive or low drive.

The results were as follows:

1. Latency: Amount or type of reinforcement was not a significant variable with respect to latency. The incentive value of small food reward, however, more nearly matched the incentive value of the amount of water employed. Such differences as do exist are largely confined to the first half of the test series. Early in the test series, latency

appears definitely to be a function of the drive level under which it is measured, but not late in the series.

2. Activity Level: Activity level offered some promise as an independent measure of drive. Activity shows a consistent upward trend throughout the test series. This cannot be accounted for in terms of some generalized increasing drive but seems to be a consequence of learned anticipation. A significant negative correlation was obtained between activity level and latency. There was a significant difference between activity levels taken following long deprivation and those taken following short deprivation. Type of reinforcement was unrelated to activity.

3. Amplitude: The amplitude of the response as measured in the present study did not prove to be related to either the amount or type of reinforcement, or to the amount of deprivation.

4. Extinction: No difference was found between animals extinguished under high drive and those extinguished under low drive in number of responses to extinction.

5. One of the significant findings of the study was the discovery that differences often appear to be a consequence of the point in the test series at which measurements are taken, rather than a simple function of some variable such as drive or reinforcement.

80 pages. \$1.00. MicA54-3184

THE CONDITIONING OF MUSCLE ACTION POTENTIAL RESPONSES RESULTING FROM PASSIVE HAND MOVEMENT

(Publication No. 10,142)

Donald Gene Doehring, Ph. D.
Indiana University, 1954

This experiment was designed as an investigation of passive movement. By recording action potentials from the muscles most likely to be involved in passive hand movement, information was obtained as to: (a) the nature of muscular responses, if any, involved in passive movements, and (b) the conditioning of muscle action potentials resulting from passive movements.

Two passive movements were used, an extension of the right hand with the palm down and a flexion of the right hand with the palm up. Action potentials were recorded from the extensor digitorum and flexor digitorum muscles of the right forearm.

In the conditioning procedure a white noise was paired with passive movement for a number of conditioning trials. Interspersed among these were test trials on which the white noise was presented alone. One group of subjects received the passive extension movement and another group received the passive flexion movement. For each experimental condition there was a control group, which received identical treatment except that no passive movement was given.

Following the conditioning procedure, subjects

were required to make an instructed extension and an instructed flexion movement, with the palm in the same position that it had been for the conditioning series.

It was found that:

1. Large muscle action potential responses from extensor and flexor muscles resulted from both types of passive movement. For both movements the difference between extensor and flexor levels was non-significant. The level of response tended to decay from the beginning to the end of the series of conditioning trials.

2. Conditioned muscle action potential responses occurred in one or both muscles for each type of passive movement. Differences between extensor and flexor level were non-significant. The level of conditioned responses reached an early maximum and then tended to decay over the remainder of the trials. This decay appeared to parallel the decay in the responses resulting from passive movement. Within trials the response level tended to increase as the time for delivery of passive movement was approached.

3. Since conditioning had occurred without any obvious form of reinforcement (in the Hullian sense of drive-reduction), the conditioning obtained in this experiment would seem to provide an exception to Hull's postulation that drive-reduction is a necessary condition for all learning.

4. There was a significant difference between extensor and flexor level in the expected direction (extensor dominance for an extension movement and flexor dominance for a flexion movement) for both instructed movements in the "palm down" group, and for the flexion movement in the "palm up" group.

5. The disparity between extensor-flexor patterns in responses resulting from passive movement and from instructed movement responses was discussed. One possibility was that passive movement responses merely involved a "startle reflex" on the part of the subject. Most characteristics of the passive movement responses, however, were different from those found in the startle responses. It was concluded that the passive movement responses could best be considered as increments of tension in both of the antagonistic muscles, with neither muscle achieving the dominance necessary for an organism-initiated movement.

69 pages. \$1.00. MicA54-3185

AN EXPERIMENTAL TEST OF A METHOD FOR DEVELOPING RATIO SCALES

(Publication No. 9689)

Trygg Engen, Ph. D.
University of Nebraska, 1954

Adviser: Frank J. Dudek

This study was concerned with the problem of developing ratio scales from psychological judgments.

Ratio scales are desirable because they make possible the use of numerical series as a model for psychological events and permit a more general mathematical treatment of subject-matter in psychology. A recently proposed method for reporting comparative judgments requires the subject to divide 100 points between two stimuli so as to express their relationship. It has been claimed that ratio scales can be computed from such judgments.

Twenty graduate students made ratio judgments by the proposed method on pairs of eleven lines of different lengths. Judgments were made with all eleven lines constituting one long range, which contained ratios as great as 36 to 1, and also with the eleven lines arranged in three shorter overlapping ranges, which contained no ratios greater than 4 to 1. Scale values were computed from point assignments made under each condition. Thus, the study allowed for the investigation of how scale values are affected by size of range of stimuli judged, magnitude of stimuli, and practice.

Size of range was shown to affect the scale values. Obtained scale values for the long range were considerably smaller than the physically measured scale values for the lines, while the obtained scale values for the shorter ranges slightly exceeded the "true" values. Presence of large stimulus differences within the long range provided a context in which differences tended to be underestimated, whereas presence of only relatively small differences in the short ranges favored overestimation.

Magnitude of stimuli also affected scale values. The short range containing the smaller stimuli produced less accurate estimations of "true" values than did the other two short ranges containing medium and larger lines.

Practice was not shown to reduce either variability in judgment or the extent of error in estimating "true" point assignments.

Characteristics of the computational method and the method of reporting judgments introduced artifacts. Since scale values are derived by successive multiplication, errors for low scale values cumulatively contribute to the errors for higher scale values. Thus, the longer the range and the larger the number of stimuli, the more the errors in estimating higher scale values will be exaggerated. Also the method of assigning 100 points to express judgments permits more accurate reporting of small than large stimulus differences, and judgments of the latter were less variable but in greater error.

The presence of ratio properties in the obtained scales was first evaluated in terms of the accuracy with which the obtained scale values estimated the "true" scale values, and it was argued that, although rank order properties were assured, ratio properties were not demonstrated in view of constant errors related to the size of the range, magnitude of the stimuli, and artifacts inherent in the method. However, from an operational point of view definition of ratio properties must ultimately be evaluated in terms of consistency of results obtained under similar conditions. While subjects are variable with respect to points assigned to stimulus

pairs on different occasions, when judgments for all subjects were combined there was high internal consistency in the results. Thus, there is some evidence to support the claim for ratio properties for this scaling method. Further studies are required to establish the internal consistency of the method and the meaningfulness of discrepancies between obtained and "true" scales. Research leading to ways of minimizing or eliminating the artifacts is also needed.

102 pages. \$1.28. MicA54-3186

AN EVALUATION OF CONCEPTUAL THOUGHT UNDER CONDITIONS OF OXYGEN DEPRIVATION

(Publication No. 9552)

Clinton Hiland Maag, Ph. D.
University of Florida, 1954

The essential goal of this research was to test several hypotheses regarding the decrement of human performance under various degrees of continuous hypoxic stress.

Ten enlisted men of the Naval Air Training Command served as subjects for this experiment.

The behavior evaluated was performance on a conceptual reasoning test designed for use in this experiment. Each subject was given pre-experimental training on the task until he reached a constant level of efficiency beyond which improvement no longer occurred.

An LPR-2 type decompression chamber was used to simulate altitudes of 13,000, 16,000, 17,000, and 18,000 feet. The subjects were exposed to these degrees of hypoxic stress for two hours and nine minutes, or until they became unconscious, whichever occurred first.

At the simulated altitudes in which measurements were obtained, a significant decrement in performance was demonstrated.

An analysis of the performance showed that under these stress conditions the subjects experienced recurring periods during which they seemed unable to respond, or they displayed atypical responses. These periods were designated as response blocks and operationally defined as those responses which exceed by plus 3.09 standard deviations the subject's mean performance during the final pre-experimental training series.

It was found that response blocks tend to increase in frequency with degree and duration of hypoxic stress. These periods were preceded and followed by a stable and uniform level of efficiency.

The relationship between measurements of performance and hypoxic stress was found to be saltatory, or stepwise, rather than continuous. Shortly after exposure to stress there was a slight decrement in the efficiency of performance. From this point to unconsciousness no further loss in efficiency was evident beyond the increasing frequency of block responses.

The results of this research indicated that during early stages of hypoxia the individual's behavior was characterized by occasional intervals during which he seemed unable to respond. As stress continued, the block intervals become more frequent, and the periods of stable behavior become less frequent. Just prior to unconsciousness the lucid periods were in the minority and the block intervals predominated. However, even during this final stage just preceding collapse, the individual was at times capable of efficient performance.

It was suggested that under stress the behavior of the individual deteriorates in a saltatory manner from higher to lower levels of organization with blocks being indicative of temporary lapses of organization. 122 pages. \$1.53. MicA54-3187

AN EXPERIMENTAL INVESTIGATION OF THE RESISTANCE TO EXTINCTION OF INSTRUMENTAL RESPONSES ACQUIRED UNDER IRREGULAR CONDITIONS OF LEARNING

(Publication No. 9695)

Irene Mackintosh, Ph. D.
University of Nebraska, 1954

McClelland points out that a major paradox in learning theory is the fact that laboratory learning is much less resistant to change than learning which occurs under ordinary conditions. He suggests that the discrepancy arises because few laboratory experiments are sufficiently "messy" or disorderly to make the discrimination between learning conditions and extinction conditions difficult for the organism. In the laboratory regular relationships hold within the cue-response-reward sequence while under ordinary circumstances learning must often occur under irregular, changing and inconsistent conditions.

On the basis of McClelland's suggestions, an experiment was conducted to test the general hypothesis that the more irregular the conditions of acquisition of instrumental responses, the greater the resistance to extinction of these responses. Three sources of irregularity were introduced into the acquisition conditions: (1) differing reinforcement schedules (total versus partial reinforcement), (2) differing numbers of manipulanda upon which instrumental reward responses could be made (one versus two versus three manipulanda) and, (3) differing drive reduction conditions (hunger versus hunger or thirst on a given trial). The sources of irregularity were combined in a 3 x 2 x 2 factorial design so that the influence of each separate source of irregularity upon resistance to extinction and their interaction effects could be measured. Forty-eight rats were assigned to twelve groups of four rats each. During acquisition one variation of each of the three sources of irregularity was represented in each group. The number of positive reinforcements and the hours of deprivation were held constant for all groups.

Following the varied acquisition training, all rats

were treated alike during extinction. Two measures of extinction, number of trials to criterion, and number of responses to criterion, were utilized. Irrelevant responses were also recorded. Resistance to extinction was measured to two different criteria. Criterion I, similar to the usual extinction criterion, was four consecutive 2 minute trials with no responses. Criterion II was eight consecutive 2 minute no-response trials, four on one day and four on the next day. The more rigorous criterion II provided a more complete measure of extinction since it included measurement of spontaneous recovery.

The results of the investigation may be summarized as follows:

1. For at least some sources of irregularity, the more irregular the conditions of acquisition the greater the resistance to extinction. Irregularity in reinforcement conditions and in manipulanda conditions caused significantly greater resistance to extinction. Irregularity in drive reduction conditions did not affect resistance to extinction.

2. The measured interaction effects were not significant so that the observed relationships should hold regardless of whether these sources of irregularity are combined or act separately.

3. The number of trials and number of responses to the extinction criteria are highly correlated.

4. Observed differences between the two criteria indicate that a rigorous extinction criterion may measure an aspect of the extinction process different from and in addition to that which is measured by a less stringent criterion. Therefore, caution is needed in comparing the results of experiments if the extinction criteria have been defined differently.

5. Spontaneous recovery, and the number of trials and responses made during the latter part of the extinction process, appear to be related to irregularity of acquisition conditions.

6. When manipulanda in addition to those appropriate during acquisition are available, many 'irrelevant' responses are made on these manipulanda during extinction.

7. The obtained results were discussed with regard to their implications for further research.

86 pages. \$1.08. MicA54-3188

THE DEVELOPMENT AND LABORATORY- VALIDATION OF A SUBJECTIVE FATIGUE SCALE

(Publication No. 9878)

George Winfield McNelly, Ph. D.
Purdue University, 1954

Major Professor: Dr. Ernest J. McCormick

A research problem in the development and validation of a subjective fatigue scale.

The problems in the area of psychological fatigue center primarily around measurement. Basically the problem consists of transforming introspective

reports of "feelings" into some type of meaningful quantitative form. Another problem arises when an attempt is made to find behavioral correlates to subjective feelings of fatigue.

The purpose of this study was to develop a subjective fatigue scale and provide a laboratory "validation" of the subjective fatigue scale. Several theoretical hypotheses were also tested.

A population of 159 words and phrases were collected. This word-phrase population represented degrees of feeling from well-being to extreme fatigue. This scale was reduced to 120 words and phrases by a check list approach where ten graduate students checked those words and phrases they thought would not be worthwhile using in a fatigue scale. Two subsequent Thurstone nine-point scalings by 20 judges resulted in two approximately equal subjective fatigue scales. These scales each contained nine stable words and phrases describing various degrees of fatigue and well-being. A simple "check method" was used to score the scale, i.e., S was merely asked to check the single word or phrase that best described how he then felt.

A laboratory experiment was designed using a simple block-turning task mounted on a variable work surface. 80 Ss were utilized in a factorial design where effort was varied by using two different weight blocks (0.4 ounces and 11.0 ounces). Type of work was varied by having Ss work under massed and spaced conditions. The subjective fatigue scale was administered in two ways: (a) before and after work, and (b) only after work.

The following hypotheses were tested:

1. Ss working under massed work conditions will feel significantly more subjective fatigue than those working under spaced conditions.

2. Performance of Ss doing massed work will be significantly slower than those Ss working under spaced conditions.

3. The heavier the weight of the blocks, the slower the time to turn 20 blocks under massed conditions.

4. Block weight will have no effect on spaced work.

5. Work habit changes can be studied by the memo-motion technique.

6. There will be a negative relation between work decrement and change in subjective fatigue.

The results of the experiment gave support to hypotheses 1, 2, 4, and 6. Hypotheses 3 and 5 were not supported by the experimental results.

135 pages. \$1.69. MicA54-3189

AUDITORY PERCEPTION IN RELATION TO AMOUNT OF INFORMATION AND SPEECH-TO-NOISE RATIO

(Publication No. 9880)

Irwin Miller, Ph. D.
Purdue University, 1954

Major Professor: L. M. Baker

This investigation related auditory perception to two variables: the degree of organization of speech stimuli, and the speech-to-noise ratio (S/N). The organization of the speech stimuli was quantified in terms of logarithmic units of information (I).

A learning phase served to familiarize 13 Ss with a nonsense vocabulary through repeated simultaneous visual and auditory presentation of the nonsense items and classificatory criteria, by means of the method of paired associates. After having reached a criterion of two perfect trials, each S participated in a perceptual phase, where the nonsense items were presented auditorily together with white noise. The items had been arranged previously into passages representing four different I rates: 1 bit (per item), 2 bits, 3 bits, and 4 bits. At each I rate, four passages were presented at S/Ns of -13 db, -6 db, +1 db, and +8 db.

The mean number of items correctly reproduced at the four I rates differed significantly at the .001 point, with the means varying as an inverse function of I. Successive tests of the residual variance following the removal of linear and quadratic components indicated that the relationship was that of a third-order function or higher.

The mean number of items correctly reproduced at the four S/N rates differed significantly at the .001 point, with the means varying as a direct function of S/N. Successive tests of the residual variance following the removal of linear and quadratic components indicated that this relationship was also that of a third-order function or higher.

An interaction between I and S/N was found to be significant at the .001 point, qualifying their effects upon the mean number of items correct. Differences in terms of the I variable were slight when the S/N was high; however, as S/N decreased the differences in terms of the I variable increased critically in a regular manner.

50 pages. \$1.00. MicA54-3190

HUMOR PERCEPTION AS ABSTRACTION ABILITY

(Publication No. 9885)

Dan C. Overlade, Ph. D.
Purdue University, 1954

Major Professor: Franklin J. Shaw

A review of the literature on humor and laughter is presented with attention given to the physiology of laughter and theories of the nature and phylogenetic and ontogenetic development of the so-called sense of humor. The review includes material dealing with the relevance of humor to such things as intelligence, society, and personality. A survey of measurement methods for assessing humor ability is included.

A theory of humor is developed upon the premise that the humor experience is the perception or discovery of an only-alluded-to meaning or interpretation. From this theory are derived hypotheses regarding behavior relevant to the humor experience.

It is predicted that under specified operations humor ability will be related to the ability to abstract meaning from proverbs and to the ability to abstract simpler geometrical forms from more complex configurations.

For the purpose of testing the experimental hypotheses, a humor test, a proverb test, and a form of the Gottschaldt embedded figures test are developed and presented.

Sixty-five university students were given the tests and correlation coefficients between humor and the proverb abstraction test scores, and between humor and figure abstraction test scores significant at the one percent level of confidence were obtained. Further statistical analysis, made possible by the availability of intelligence (ACE) estimates on 37 of these experimental subjects revealed that intelligence is significantly related to performance on the humor test though not to proverb or figure performance. Control of intelligence through partial correlation techniques further reduced the coefficient of relationship between humor and proverb performances (otherwise significant at the .05 level for the smaller group), but not below the point of significance. The relationship between humor and figure skill, for the smaller group, was not significant.

It is concluded that humor ability as operationally defined in this study is related to the ability to abstract meaning from proverbs, to the ability to discover simpler figures hidden or embedded within more complex configurations, and to intelligence as measured by the ACE. It is further concluded that the experimental results in general support the theoretical position that an ability to abstract the obscure from the obvious in verbal or configurational material is an important factor in the perception of humor.

144 pages. \$1.80. MicA54-3191

**SOCIAL DISTANCE AND HOUSING: AN
INVESTIGATION OF THE ATTITUDES
OF AN INDUSTRIAL POPULATION**

(Publication No. 9886)

John Peter Paisios, Ph. D.
Purdue University, 1954

Major Professor: H. H. Remmers

The purpose of this study was to explore, by a modification of Bogardus' method of social distance, the degree of residential distance that respondents of an industrial sample would extend to members of several ethnic groups. Residential distance was defined as the degree of neighborhood proximity the respondent was willing to permit the particular ethnic group in question.

The respondents were drawn from the total labor force of two large steel companies of northern Indiana. These respondents had indicated by their responses to a housing survey questionnaire that they were in the market for housing within the Greater Calumet Area, the area of interest to the sponsors.

After certain adjustments, there were 498 such respondents who were themselves identifiable by their cultural and also their occupational membership. In terms of cultural membership, there were 234 American Whites, 170 American Negroes, and 94 Mexicans. Each of these ethnic groups was looked upon in turn as an in-group and the degree of residential acceptance-rejection each would grant selected ethnic out-groups was obtained. Six ethnic out-groups, selected to be representative of the many groups living in the Calumet Area, were identified for study. These six groups were: English, Chinese, Mexican, Negro, Polish, and Puerto Rican.

For each reference or in-group the unique pattern of its residential tolerance-intolerance for the respective out-groups was determined. These patterns of residential acceptance were identified and then subjected to several comparisons, both within and between the three in-groups. These comparisons were phrased as null hypotheses, and on the basis of the significance tests of the analysis of variance, were rendered more or less tenable. Appropriate conclusions were drawn from significance tests dealing with:

1. The rank orders of residential acceptance for ethnic out-groups given by each in-group, both within and between the in-groups.
2. The relationship between occupational level within each in-group and residential acceptance.
3. The differences in absolute levels of acceptance for all out-groups, as given by each in-group.
4. The presence or absence of general attitudes of residential acceptance or rejection.

106 pages. \$1.33. MicA54-3192

VARIABLE DELAYED REINFORCEMENT

(Publication No. 10,035)

Lloyd Richard Peterson, Ph. D.
University of Minnesota, 1954

The main purpose of the study herein abstracted was to investigate the effects of varying aperiodically the time interval between occurrence of a response and the presentation of a reinforcing stimulus. A secondary purpose was to investigate the effect on establishment of a secondary reinforcer of varying aperiodically the temporal interval between occurrence of the originally neutral stimulus and the presentation of a primary reinforcer.

Rats were trained in a four foot runway under four different schedules of food reinforcement: continuous immediate reinforcement, continuous variable delayed reinforcement, aperiodic immediate reinforcement, and aperiodic variable delayed reinforcement. A buzzer sounded on all trials for the above four experimental groups as each animal entered the goal box. For a fifth control group which was trained on a continuous immediate schedule of reward the buzzer did not sound in the goal box at any time. Measures of time between raising of the starting box door and entrance of the animal into the goal box were recorded.

An analysis of variance showed delayed animals to be running more slowly on the twelfth day of runway training than immediately reinforced animals. Aperiodically reinforced animals were slower than continuously reinforced animals. The interaction between these two factors was significant.

The animals were tested in a bar pressing device following runway training. A bar press was followed by sounding of the buzzer for three seconds, but no food was ever given in the device. The group which had been reinforced on a continuous variable delayed schedule in the runway was the only group which pressed the bar significantly more times than the control group which had never experienced the buzzer in the runway.

The animals were then extinguished in the runway to the criterion of two successive trials with time over one minute. Animals which had been delayed on acquisition trials were found to be significantly more resistant to extinction than animals whose reinforcement during acquisition had been immediate. Animals whose reinforcement during acquisition had been aperiodic were significantly more resistant to extinction than animals whose acquisition schedule of reward had been continuous.

The relation between acquisition measures of response strength and extinction measures of response strength was discussed with reference to the factor of similarity between acquisition and extinction conditions.

69 pages. \$1.00. MicA54-3193

**A STUDY OF HOSTILITY AS REFLECTED
BY THE DIFFERENTIAL LEARNING AND
RETENTION OF SCHIZOPHRENIC PATIENTS**

(Publication No. 9893)

Burton W. Robinson, Ph. D.
Purdue University, 1954

Major Professor: Lawrence M. Baker

This study attempts to apply some of the experimental findings about selective memory to the study of the hostility and perception of hostility of paranoid schizophrenics. The basic assumption of the experimental design is that subjects tend to retain material that is in harmony with their frames of reference and to forget material that conflicts with them. Other important assumptions are that paranoid schizophrenics (1) feel more hostile toward other people and (2) perceive other people to be more hostile toward them than do hebephrenic schizophrenics or normal subjects. Experimental support for these assumptions is cited in a rather extensive survey of the literature. From the assumptions made, a number of specific experimental hypotheses are derived concerning the selective retention of material designed to reflect the hostility and perception of hostility in the different groups.

Experimental groups in the first part of the study consist of 38 paranoid schizophrenics, 35 hebephrenic schizophrenics, and 30 hospital aides. Lists of short evaluative statements about people in general are presented to these subjects. They are then tested for immediate, 30-minute, and 24-hour recall of these statements and for 24-hour recognition from a longer list. The major hypothesis in this part of the study is that paranoid schizophrenics will retain a differentially greater amount of unfavorable than favorable material than will either of the other groups. When difference scores are analyzed, no significant differences in retention are found between the three groups. The trend is, however, in the predicted direction. When the data are analyzed in terms of numbers of subjects retaining more unfavorable than favorable statements, not only are the differences between groups in the predicted direction but they also approach, and in a few instances attain, statistical significance.

Only schizophrenic groups are used in the second part of the study. The retention periods are identical to those previously used. The experimental material, however, consists of lists of evaluative statements which employers are supposed to have made in comparing discharged mental patients with other workers. The major hypothesis of this part of the study is that paranoids will selectively retain a differentially greater number of unfavorable than favorable statements about discharged patients than will hebephrenic schizophrenics. The data, as a whole, do not support this hypothesis. Both groups retain a much larger proportion of favorable than unfavorable statements. Some slight, but not statistically significant, support for the hypothesis is found in a shift in the types of material recalled by the groups after 24-hours.

The results obtained are presented in tables and illustrated graphically. The relationships between these results and the hypotheses are discussed. Limitations of the study with possible reasons for the lack of more positive support of the hypotheses are presented and discussed along with implications for further research.

The data fail to give clear-cut support for the hypothesis that paranoid schizophrenics will retain a differentially greater amount of unfavorable than favorable material about people than will hebephrenic schizophrenics and normal subjects. There is, however, a trend toward support and some of the differences between groups are statistically reliable. No reliable support, however, is found for the hypothesis that paranoid schizophrenics will retain a differentially greater number of unfavorable than favorable statements about discharged mental patients than will hebephrenic schizophrenics.

86 pages. \$1.08. MicA54-3194

**THE EFFECT OF RATE AND ENERGY
UPON THE PERCEPTION OF
APPARENT MOTION**

(Publication No. 9720)

Rayford T. Saucer, Ph. D.
University of Florida, 1954

The effect of the repetition rate of a serial presentation of two stimuli upon the perception of apparent visual movement has been contrasted with the effect of stimulus intensity changes.

According to Korte's laws the temporal factor in the necessary stimulus configuration has been pause time between presentations. The hypothesis that rate subsumes pause time and is therefore a more general term has been advanced and tested.

Sixteen subjects were tested under four conditions of rate and four conditions of intensity. The results of the experiment were analyzed by using number of reversals of perception and average length of perception as the index of apparent motion. Complex analysis of variance was used as a method of statistical analysis.

The major null hypothesis can be rejected at the .001 level of confidence. It is concluded that rate is effective as a variable in determining the amount of apparent motion perceived. The temporal factors contained in the rate are related to the temporal factors contained in the traverse time of a real object across the retina.

47 pages. \$1.00. MicA54-3195

DRIVE, BARRIER CONDITIONS, AND
PERSONALITY VARIABLES AFFECTING
PROBLEM-SOLVING BEHAVIOR

(Publication No. 9146)

Charles Marion Solley, Jr., Ph. D.
University of Illinois, 1954

A survey of the literature on "frustration" was made and the relationship between "frustration" and barrier conditions was analyzed. A conceptual model was developed. In this model, a barrier was defined as an event which occurred to prevent S from approaching a goal. Barrier Behavior, in turn, was defined as behavior at or immediately following the encountering of the barrier.

The model indicated that barriers serve to increase the intensity of motivation. It also predicted a decrease in efficiency of behavior. The model, further, predicted that the behavioral consequences of barriers was dependent upon how "valuable" the individual perceived himself. A secondary prediction was that Ss implicitly avoid "goals" which are "negative-affective" in character but implicitly seek "goals" which are "positive-affective." An experiment, accordingly, was designed to test these predictions.

The S was presented with the task of solving anagrams. Three types of solution words (goals) were used - "positive-affective" words such as "beauty," "neutral" words such as "chair," and "negative-affective" words such as "death." Solution words were equated as to frequency of occurrence in printed English and anagrams were equated as to "degree of disorder" among the letters. The three types of solution words (goals) and three magnitudes of barriers - zero, three, or five insoluble anagrams in succession - formed a three by three factorial design. A total of 90 Ss were used - undergraduates at the University of Illinois. Ten Ss were randomly assigned to each of the nine cells of the design.

The basic procedure was to present six soluble anagrams, which were followed by either zero, three, or five insoluble anagrams, which, in turn, were followed by six more soluble anagrams. A fingerprint stain index of palmar sweating was used to measure intensity of motivation, being taken before and after the anagram task. "Spontaneous" comments emitted during the presence of the insoluble anagrams was a second dependent variable. The third dependent variable was solution time for anagrams immediately following the barriers. In order to measure "perception of value of self" each S checked twelve of Osgood's semantic differential scales with high factor loadings on the evaluative factor.

The analyses of the data showed an increase in palmar sweating - intensity of motivation - with increases in magnitude of barriers. Also, there was an increase in solution time for anagrams after the barriers as a function of magnitude of barriers. Further, individuals who perceived themselves to be "valuable" made more "task-oriented" comments while individuals who perceived themselves to be less "valuable" made more "self-blame" comments. The results also showed that as barriers increase

in magnitude perception of "value of self" becomes a more important determinant of solution times. It was shown that Ss take longer to solve "negative-affective" words, "neutral" words intermediate, and "positive-affective" words the shortest.

Results were discussed and related to pertinent studies in the literature. Suggestions were made for possibly fruitful, future research.

160 pages. \$2.00. MicA54-3196

LEVEL OF PERFORMANCE IN THE RAT AS
A FUNCTION OF TRAINING AND OF
SUBSEQUENT PARTIAL REINFORCEMENT

(Publication No. 9627)

Norman Willard, Jr., Ph. D.
University of Minnesota, 1954

Major Advisor: W. T. Heron

Several studies of the effect of partial reinforcement have been conducted on animals which had been pre-trained under continuous reinforcement. These studies are often compared with others in which partial reinforcement is administered after little or no training under continuous reinforcement. No systematic investigation has been made of the effect of pre-training under continuous reinforcement upon performance under partial reinforcement.

Reinforcement theory permits the prediction that animals will react differentially to a partial reinforcement schedule as a function of the initial strength of the response. This may be derived from a hypothesis which proposes that partial reinforcement produces greater resistance to extinction because of the secondary reinforcing properties of the after-effects of a non-reinforced response.

The present investigation was designed to test the hypothesis that: There will be no difference between the levels of performance of groups of white rats which have received different amounts of training on a two-choice problem under continuous reinforcement, when that performance is tested under like conditions of partial reinforcement. The design also permitted the test of two secondary hypotheses.

Five groups of thirty animals each received different amounts of training on a position response in a single unit tunnel Y-maze under continuous reinforcement. The number of training trials for the respective groups was: 20, 40, 60, 80, and 100. At the end of these trials the groups were sub-divided into smaller groups of five animals each. The smaller groups from any given training group were tested under different schedules of partial reinforcement. The reinforcement ratios used were: 80:20, 60:40, 40:60, 20:80, 0:100 and a schedule which presented each of the foregoing ratios for 20 trials of the total of 100 trials in the performance test series.

The score obtained in this study was the number of responses to the arm of the Y which had provided

the continuous reinforcement during the training phase of the study.

Because of the lack of homogeneity of variance, the results were analyzed both by analysis of variance and by a non-parametric test. In general, there is high agreement between the interpretations derived from the two methods of analysis.

The different amount of training produced significant differences in level of performance prior to the introduction of partial reinforcement. At the end of 20 trials under partial reinforcement, there was no difference between the training groups under each partial reinforcement schedule. However, differences in level of performance as a function of ratio of partial reinforcement were significant beyond the one per cent level for each training group. At the end of 100 test trials under partial reinforcement, the differences between groups under different partial reinforcement ratios were even more marked.

On the basis of the findings reported in this study, it is impossible to reject the hypothesis. No differences were demonstrated between groups that received different amounts of training under continuous reinforcement when those animals were tested under similar conditions of partial reinforcement.

Analysis of the groups tested under diminishing partial reinforcement indicated that, after 60 or more training trials in the two-choice situation, prior experience on a partial reinforcement schedule operates to hold rat performance at a higher level than would be found in a group tested after a direct continuous-to-partial shift. These differences were significant at the one per cent level.

74 pages. \$1.00. MicA54-3197

RELIGION

**MAKER OF HEAVEN AND EARTH:
A THESIS ON THE RELATION BETWEEN
METAPHYSICS AND CHRISTIAN THEOLOGY
WITH SPECIAL REFERENCE TO THE
PROBLEM OF CREATION AS THAT PROBLEM
APPEARS IN THE PHILOSOPHIES OF
F. H. BRADLEY AND A. N. WHITEHEAD
AND IN THE HISTORIC LEADERS
OF CHRISTIAN THOUGHT**

(Publication No. 10,175)

Langdon Brown Gilkey, Ph. D.
Columbia University, 1954

This thesis deals with the general problem of the relation between speculative metaphysics and Christian theology. It seeks to elucidate this relation by means of a comparison between metaphysics and theology based upon one given problem common to the two disciplines. This common problem dealt with throughout the thesis is for philosophy the central problem of ontology, namely the problem of the relation of finitude to its ultimate ground, and for theology the problem of the doctrine of Creation. The representatives of philosophic enquiry whose thought is analyzed and discussed are F. H. Bradley, the monist, and A. N. Whitehead, the pluralist; on the theological side, representative Christian thinkers are used in an attempt to elucidate and to develop systematically the Christian doctrine of Creation. Thus the thesis is mainly concerned with developing the philosophic and theological answers to the problem of ultimate origins, and with comparing, both with regard to methodology and content, the contributions which these two types of thinking have to offer.

The thesis is not, however, merely expository. It seeks to show that philosophy and theology must work together in a certain relationship if full intelligibility on this problem is to result. For one of its conclusions is that philosophical method alone cannot reach satisfactory answers to man's ultimate questions. Thus in the criticism of the thought of Bradley and of Whitehead it is shown that in each case the metaphysical method adopted at the outset by each philosopher itself prevents the solution of the problems which his philosophy seeks to resolve. In Bradley the sole source of intelligibility, namely the Absolute, finally becomes so transcendent as to be unknown and unknowable, with the result that finite life has no discernable relation to an ultimate intelligibility. In Whitehead, on the other hand, the philosophical attempt to comprehend the totality of things in terms successfully applied to finite events breaks down when these same terms are univocally applied to the ultimate source of meaning and coherence. Finally, therefore, in the elucidation of the doctrine of creation, a doctrine which depends throughout on the

notion of a God transcendent to his creation but actively related to it and which finds its source in the revelation of this God in history, the further attempt is made to show how this Christian notion contains the basis for that ultimate intelligibility for which philosophy had sought and which it had failed to find. Thus one conclusion of the thesis is the assertion that the theological method of revelation and the theological doctrine of creation are the bases for a more ultimate intelligibility than philosophical method and speculation can offer.

The final concern of the thesis, however, is to show that the primacy of theology on ultimate questions does not involve the negation of the value or the possibility of metaphysical inquiry. Theology needs philosophical ontology because its God is the source of being and therefore must be understood in ontological categories. Hence a full understanding of God requires that he be conceived not only in the personal and historical categories of religious faith and of revelation, but also in terms of the ontological categories of metaphysical speculation. Thus a union between Christian theology and metaphysics is as essential for a complete theology as for a full metaphysics itself. The final section of the thesis attempts, therefore, to deal with the problem of a Christian philosophy: how is such a philosophy possible if it is to be congruent both with the doctrine of creation which has its source in religious faith, and with a free empirical method essential to a genuine philosophic enquiry? In resolving this final problem the thesis seeks to show that the Christian understanding of life can provide not only the ultimate intelligibility of faith but also the proximate intelligibility of philosophical and scientific enquiry, and can thus combine the best elements of both the theological and the philosophical methods which it had been the purpose of the thesis to compare.

627 pages. \$7.84. MicA54-3198

**AN APPRAISAL OF TWO TYPES OF
PRE-MINISTERIAL TRAINING PROGRAMS OF
THE LUTHERAN CHURCH-MISSOURI SYNOD**

(Publication No. 10,037)

Willy August Poehler, Ph. D.
University of Minnesota, 1954

This study sought to appraise two kinds of pre-ministerial training of the Lutheran Church - Missouri Synod. Differences in spiritual maturity between students trained in the two types of pre-ministerial programs were investigated in terms of scores earned on a special test developed for this study, A Ministerial Aptitude Test.

Students from the ten pre-ministerial colleges and the two seminaries of the Lutheran Church - Missouri Synod were used for the purpose of developing the special test and in order to study the differences between the two types of training.

The Ministerial Aptitude Test was designed to measure three components of "spiritual maturity:" "Bible knowledge," "doctrinal knowledge," and "adult Christian behavior." These qualities have been generally accepted by the Missouri Synod as constituting critically important factors of spiritual maturity.

The validity of this test was determined by its correlation with honor-point-ratios of theological students, an estimated validity of .47, based on 170 students being obtained, and on the consistently better performance of lower, middle and upper classes at the two Missouri Synod seminaries.

The reliability of the Ministerial Aptitude Test was estimated on the performance of 217 first-year theological students at St. Louis and Springfield, at the beginning of their training and of 185 of these same students at the end of the first semester of theological training. Coefficients of .87 and .85 respectively were obtained by use of the Hoyt analysis of variance technique.

The Ministerial Aptitude Test has a low correlation with scores on the A. C. E. Psychological Examination. The correlation coefficients ranged from .30 to .50 for the various parts of the test at the two seminaries at St. Louis and Springfield respectively.

Further use of the test is warranted on the basis of the validity and reliability estimates. However, two facts should be kept in mind when using the test: (1) The test measures only some of the components of spiritual maturity and (2) the estimates of validity and reliability are based on a comparatively small number of cases.

The students studied came mostly from urban communities of the Middle-West, one third from homes of ministers and teachers. All belonged to some branch of the Lutheran Church. Springfield students were about two years older than St. Louis students. The latter were found to achieve higher

scores on the A. C. E. Psychological Examination than Springfield students.

The two pre-ministerial programs differed both on high school and college levels. St. Louis students received more language and religion study in high school than Springfield students and were trained mostly in private and synodically owned schools and colleges. Springfield students came predominantly from public schools and received more instruction in mathematics, science, fine arts, industrial arts on the high school level and more psychology, humanities, and music on the college level.

Two randomly selected samples of 39 first-year theological students from each of the two seminaries were used to test the major hypotheses in this investigation concerning differences between the two pre-ministerial programs. The St. Louis students were found to be generally superior to the Springfield students in Bible knowledge and doctrinal knowledge. No differences were observed in adult Christian behavior. At both schools upper classes were superior to the lower and middle classes, except in the test on adult Christian behavior where no distinct pattern of superiority emerged. However, when differences in intellectual ability were controlled by statistical techniques, no difference was observed between St. Louis and Springfield students on any of the three parts of the Ministerial Aptitude Test.

Inferences drawn from these findings include the following: More students of high intellectual ability attend St. Louis than the Springfield seminary, though both student bodies are highly selected, with intellectual abilities well above average. The effectiveness of a pre-ministerial program does not seem to be reduced with respect to spiritual maturity merely because part or all of the student's course work on high school level is taken in a public school. The Ministerial Aptitude Test appears to measure factors other than intelligence and may find usefulness as an additional device for the prediction of success in ministerial training.

235 pages. \$2.94. MicA54-3199

SOCIAL PSYCHOLOGY

SOME PERCEIVED PROPERTIES OF SOCIAL INTERACTION

(Publication No. 9740)

Marvin Gerard Cline, Ph. D.
Cornell University, 1954

Although terms such as "social interaction" and "group" have been used by social psychologists as descriptions and experimental variables, they have not been studied as apprehensible entities or conditions for the acquisition of social knowledge. The

purpose of this paper is to explore the possibility that interaction between two people provides an external observer with the perceptual conditions for noting the properties of the people involved. This requires interaction to be phenomenally isolable and effective in determining the properties of the interacting individuals. This paper is concerned with the fruitfulness of distinguishing between the properties of individuals who are interacting and the properties of the interacting process. Such a distinction can be fruitful if it can be shown that some of the perceived properties of the individual people derive directly from the

psychological conditions prevailing between them. The conclusion could then be drawn that the sequence of mutually directed intentions and feelings is a real dimension of perceptual experience which could be the source of social understanding heretofore ascribed to *ad hoc* mechanisms such as empathy or projection.

In order to simplify the study of the effects of interaction on perceived properties of the participants, outline drawings of three-quarter view faces with different expressions were constructed. When placed next to each other, the lines of gaze of two drawings apparently meet so that a clear cut situation of two people looking at each other is created. Reversed tracings of each drawing were made so that any combination of drawings with a right or left view could be constructed.

A series of seven point Likert-type scales was developed to facilitate the quantification of descriptions of each situation and the drawings composing it. Each situation was rated on these scales by a different group of undergraduates. A basic set of three drawings in various combinations and under different experimental conditions was used to make eight two-figure situations.

Of the 55 scales used to describe the situations and drawings only six failed to show high inter-subject agreement. Despite the apparent lack of specificity in the outline drawings, judgments of each situation did not vary to the extent that the differences in need structure between subjects might be expected to vary. The scales must, therefore, refer to aspects of the situation and drawings which are rooted in the stimulus and are not significantly dependent upon the perceiver, although they include references to the feelings, intentions, interests, control, etc. of the individual drawings as well as to the properties of the total interacting situation.

Hypotheses which emerge from an analysis of the rating scales are: (1) the presence of a higher order perceptual variable which is a unit composed of two mutually directed faces; (2) the presence phenomenally of properties of this unit which are psychologically prior to and determinative of some of the properties of the member faces; (3) the effectiveness of directed intentions as intrinsic properties of faces which tend to unite them into perceptual units with the objects of the intentions.

The implications of these hypotheses are discussed in the light of the proposition that the significant potentialities of social behavior as a perceptual stimulus have not been exhausted. It is suggested that a good deal of the social knowledge which has heretofore been considered the contribution of the perceiver is in reality given in stimulation. This study is an attempt to refer more specifically to dimensions of social organization which might serve as the stimulus for such knowledge.

138 pages. \$1.73. MicA54-3200

DISCREPANCIES IN ROLE EXPECTATIONS FOR THE SUPERVISORY POSITION - A CONCERN OF SOCIAL WORK ADMINISTRATION

(Publication No. 9617)

Helen M. Jambor, Ph. D.
University of Minnesota, 1954

This study was undertaken in order to test the validity of the assumption that effective social work administration depends upon a clear understanding by staff members of functions of their own and related positions, and of the principle which makes explicit the use of job descriptions in the administrative process. To test this assumption and principle, responsibilities of the supervisory position were selected in the following areas: Assignment, teaching, control, and evaluation.

Major objectives were to determine whether there was an association between: (1) High role conflict (defined as discrepancies between the supervisor's role expectations and those he perceived superiors and caseworkers to have) and indicants of less effectiveness in supervisory performance; and (2) high job specificity (a composite score of adequacy and use of written job descriptions) and agreement between superiors and supervisors, and among supervisors in the same agency, on role expectations.

Twenty-nine social casework agencies participated in this field study. Executives submitted minimal information regarding their agencies and written job descriptions for the supervisory position (when available) by mail. Supervisors of each agency met with a research worker, in a group, to fill out a questionnaire and their immediate superior filled out another questionnaire, separately. Responses of 29 superiors and 143 supervisors were used in the analysis. Chi square was the statistical method employed, with one exception in which the variance ratio test was used.

Significant differences were found between high and low groups of Role Conflict with Superiors on most measures. Associations were found between high role conflict and (1) less accurate supervisory perceptions of superiors' role expectations; (2) more responsibility placed upon superiors for supervisors' performance failures; (3) less respect for competency of superiors; (4) less satisfaction with job and agency; and (5) less attraction to the agency. Differences between high and low groups were either significant or approached it for Role Conflict with Caseworkers and measures which reflected supervisory attitudes toward superiors, as in (2), (3), and (4) above. Contrary to prediction, an association was found between low role conflict and supervisors' emphasis on achievement in own assignment rather than on achievement of agency as a whole. Findings on the association of high role conflict and less attraction to the social work profession were inconclusive.

In large agencies no differences were found between high and low job specificity and actual discrepancies between superiors' and supervisors' role expectations; in smaller agencies those with low job specificity had significantly lower actual discrepancies.

No explanation is offered for this. More variability regarding role expectations was found, as predicted, among supervisors in agencies with low job specificity than in those with high job specificity. Size of agencies was not controlled.

Findings from ex post facto hypotheses revealed that high role conflict was associated with lower salaries of supervisors, less professional training of assigned caseworkers, and larger number of assigned caseworkers. Associations were found between high job specificity and supervisors' inclusion in agency decision-making, and more freedom in the supervisory job, as reported by superiors. Findings of ex post facto hypotheses are subject to further rigorous tests, however.

Results substantiated the assumption that clarity of functions was associated with indicants of effective performance, which is an aspect of administration, and the principle of use of written job descriptions. The writer believes, however, that administrative devices and practices are most effective when the social climate in the agency is conducive to cooperative relationships.

184 pages. \$2.30. MicA54-3201

ATTITUDES TOWARD EMPLOYMENT OF OLDER PERSONS

(Publication No. 10,031)

Wayne Kermit Kirchner, Ph. D.
University of Minnesota, 1954

Major Advisor: Donald G. Paterson

The purpose of this thesis was to outline the development and use of a scale designed to measure attitudes toward employment of older persons. In this manner, attitudes as a potential barrier to employment could be objectively measured. The increasing numbers of older persons in the nation coupled with decreasing participation of these persons in the labor force made a closer look at all possible barriers to productive utilization of oldsters necessary. In addition, a review of relevant literature revealed no attempt had been made to obtain an objective total attitude score in this area.

Developmental work began in 1952 when the original pool of items was formulated and 53 items were selected by four judges as worthy of more study. These items were given originally to two groups, college psychology students and supervisory trainees. Using the Likert method of summated ratings, items were revised and presented to a group of laundry employees. Final analysis of these three samples, using the ability of each item to discriminate between top and bottom quartiles as a criterion, yielded the present 24 items. For each respondent, a total objective score was obtained.

Following this, eleven more samples were tested over a two year period. Ordnance plant employees and supervisors, Minnesota psychologists, local

guidance workers, nationwide and local personnel managers, supervisory trainees, retired union members, two divisions of the American Psychological Association, Experimental and Maturity and Old Age, and a general sample of the state population were sampled by mail survey, personal interview, or group testing. Almost 1500 persons participated.

Scale reliability was checked in three ways. Split-half coefficients (.60 to .92) and test-retest results (average r of .67) indicated fair reliability. Standard errors of true scores were low and approximately equal for all groups, indicating equal reliability regardless of the magnitude of the reliability coefficients.

Comparison of all samples revealed two clusters of mean attitude scores. Rank-and-file employees from the laundry and ordnance groups plus retired union members had higher, more favorable scores. Lower scores, approximately neutral, were obtained by psychologists, supervisors, guidance workers, personnel managers, and the general sample. Mean differences between these two clusters were statistically (7-15 points) and practically significant.

Within each sample, differences on personal variables were few. Age was positively related to attitude score in the laundry and ordnance rank-and-file groups and in the general sample. However, for other samples age and attitude scores were not highly related. Similar non-significant results were found on variables of sex, marital status, education, and number of years on the job. Differences were found in attitude score between supervisors and non-supervisory employees in the ordnance and laundry samples (production line work) with supervisors having lower, less favorable scores. No differences were found, however, between supervisors and non-supervisors in non-production type work.

Analysis of individual item responses showed that only three of the five responses were used greatly (Agree, Undecided, Disagree). Psychologists used the undecided choice much more than non-psychologists.

Similar rankings were found between the various samples when mean item scores were compared. For groups with higher mean total scores, there was a tendency for nearly every mean item score to be higher than corresponding mean item scores in groups with lower mean total scores.

In general, the scale was considered to be a reliable instrument that could differentiate between persons that held different attitudes toward older persons. Further work with and beyond the scale was postulated.

145 pages. \$1.81. MicA54-3202

NORMATIVE BEHAVIOR AND EMOTIONAL ADJUSTMENT

(Publication No. 10,179)

Thomas Simon Langner, Ph. D.
Columbia University, 1954

A rural farming community of 1500 people in Southern Colorado was the site for an inquiry into the general area of normative behavior and its relationship to emotional adjustment. The author administered various clinical and social-psychological tests to a sample of 600 school children from the fourth to the twelfth grades, one third of these being Indian, one third "Anglo" or white Protestant, and one third "Spanish" or Mexican. The hypothesis tested in this research is that conformity to norms is associated with emotional adjustment, and deviance from norms is associated with emotional maladjustment.

It appeared that conformity not to all norms, but specifically conformity to certain behavioral norms (choice of friends from the in-group only) was related to emotional adjustment (as measured by the Rorschach Test). Conformity to attitudinal norms (those governing racial prejudice) was not related to emotional adjustment.

Conformity to the behavioral norms of teachers or parents was not related whereas conformity specifically to peer group behavioral norms showed a positive relationship to emotional adjustment.

While conformity to peer group behavioral norms was positively correlated with emotional adjustment, deviance did not necessarily condemn the individual to emotional maladjustment. There were several factors which seemed to make it possible for the individual to deviate from peer group norms and still not suffer the emotional consequences of his deviance: the visibility of the deviance, the negative value which the community attached to the deviance, and the degree of homogeneity and restrictiveness of the community.

Deviance from peer group norms produced emotional maladjustment mainly because the deviance was instrumental in bringing about the social isolation of the individual deviant. This cut off a main source of the deviant child's emotional gratification, the peer group, thereby producing emotional maladjustment.

Those deviants (children who chose out-group friends) who had no friends in the in-group showed emotional maladjustment. Those deviants who had friends in the in-group (as well as in the out-group) did not exhibit emotional maladjustment. Apparently isolates from the in-group who sought compensatory friendships in the out-group were emotionally maladjusted individuals either because of their friendliness toward the out-group, or because of previous emotional problems, or because of a combination of both factors.

Severe emotional maladjustment was found among extremely popular children who had no close friends, but many distant ones. Those children who had friends but thought they had none were more disturbed

than those who had none but thought they had some. The feeling of isolation was a greater determinant of emotional maladjustment than actual isolation. Social status, ethnic group, and academic standing had an effect upon popularity, but mutual friendship rather than popularity, was positively correlated with emotional adjustment.

218 pages. \$2.73. MicA54-3203

A STUDY OF PEER RELATIONSHIPS WHICH CHILDREN IN THEIR LATENCY YEARS ARE OBSERVED TO FORM DURING 25 GROUP THERAPY SESSIONS

(Publication No. 9618)

Juanita Mariella Luck, Ph. D.
University of Minnesota, 1954

This study of group therapy in the Amherst H. Wilder Child Guidance Clinic, St. Paul, Minnesota, had two foci: (1) the development of a scale that would reflect the movements which a child makes (a) toward, (b) against, and (c) away from a relationship with another or others during group therapy sessions, and (2) the determination of the degree of association between peer relationship scores and specific socio-logical and treatment factors.

The null hypothesis was: there is no significant difference between children achieving high scores and children achieving low scores on scales of measurement of peer relationships on a one-to-one basis and/or on a one-to-subgroup basis during 25 consecutive group therapy sessions with respect to the following factors:

1. Ordinal position;
2. Occupational role of the family head;
3. Marital status of parents;
4. Age;
5. I. Q. rating;
6. Feelings toward siblings;
7. Reason for referral;
8. Clinical diagnosis;
9. Types of treatment combined with group therapy
10. Size of the group therapy sessions;
11. Program activities of the child in each session.

A subuniverse of 40 cases carried during 1950-53 act the criteria for selection: children within their latency years (6 through 11), and having completed 25 group therapy sessions.

Two scales were developed: the A scale which measures the child's relationships on the one-to-one basis, and the B scale, the child's relationships on the one-to-subgroup basis. In order to secure a measure of movement toward or away from relationships, the scales were constructed of seven intervals ranging from -3 through +3. The positive numbers indicate movement toward relationships, while the negative numbers a movement away from, or against,

relationship. Zero was used when the child was making no movement in relation to peers.

The scores were applied to 1,000 group therapy sessions and over-all scores were computed. Thus, three scores for each child were obtained: the combined A and B scores, the A scores, and the B scores.

Reliability was established, using the rank order correlation coefficient:

1. Test-Retest: $\rho = +.964$ on the A scale, and, on the B scale, $\rho = +.931$.
2. Correlation between the ratings made by an independent rater and the writer were: on the A scale, $\rho = +.924$, and on the B scale, $\rho = +.904$.

On the basis of rank order, two groups of children were secured: those having high scores and those having low scores. Using Chi-square test of significance, acceptance set at the 5 percent level, the following were the major points in the findings:

1. No significant difference was found with respect to any of the sociological factors between children having high and children having low scores.
2. With respect to the treatment factors:
 - a. No significant difference was found between high and low scores with respect to the clinical diagnosis or the number of individual psychiatric interviews the children received in addition to group therapy.
 - b. Significant difference was found between the children receiving high and low scores with respect to:
 1. learning problems;
 2. psychological remedial work;
 3. size of each individual group therapy session;
 4. program activities.

These findings suggest that the scales discriminate between the two groups of scores children received with respect to those factors which are inherent to group activity therapy. Although the ratings obtained were made from the surface behavior of each child as recorded by the group worker, the sequential ratings revealed the child's mode or way of relating to another or others at any particular time during group treatment.

244 pages. \$3.05. MicA54-3204

THE EFFECTS OF PUBLIC AND PRIVATE CHANGES OF OPINION ON INTRA-GROUP COMMUNICATION

(Publication No. 10,047)

Dorothy McBride, Ph. D.
University of Minnesota, 1954

Advisor: K. E. Clark

The purpose of the investigation was to determine conditions which result in two types of com-

pliance with group influence: (1) public compliance with private acceptance and (2) public compliance without private acceptance. The first of these was operationally defined as compliance which is maintained in the absence of persons who exerted influence. The second is compliance which disappears upon removal of the source of influence.

An experiment designed to test three hypotheses was carried out. These were: (1) that public compliance with private acceptance is a function of the attractiveness of the group, more attractive groups being better able to influence members, (2) public compliance without private acceptance may result when group members are offered rewards contingent on compliance with influence, but will not occur if no rewards enter into the influence process, and (3) that public compliance without private acceptance occurs more often, for the same reward, in less attractive groups or on issues irrelevant to the group.

The investigation utilized eight experimental conditions, seven or eight groups of five to seven members in each of the conditions. In four conditions, a reward was offered to group members for compliance with influence. In four no reward was offered, but influence attempts were otherwise identical. Experimental manipulations were introduced to vary cohesiveness, or group attractiveness, and relevance within both reward and non-reward conditions.

The subjects were high school students who participated in a discussion of curfew regulations for teen-agers. All discussions were conducted by writing notes. In reward conditions, all subjects received standard prewritten notes, ostensibly written by another group member, offering a reward for compliance with influence. In non-reward conditions, no such offer was made. Communication and measures of public and of private opinion were obtained from all subjects.

The results were: (1) Public compliance without private acceptance occurred almost exclusively in the reward conditions. (2) Low cohesive groups, rather than obtaining more public compliance without private acceptance through the reward, were better able to accomplish influence which was privately accepted. No more members of high cohesive groups complied privately in the reward conditions than in corresponding non-reward conditions. (3) An analysis of communication indicated that most subjects who complied privately in the low cohesive-reward condition originally complied only publicly. However, they did so earlier in the discussion than subjects who complied publicly in high cohesive groups.

These results were interpreted to mean that the act of public compliance sets up forces in the direction of private compliance. According to this interpretation, the failure of more attractive groups to obtain private compliance through the reward was a failure to obtain public compliance soon enough to allow such forces to operate. Two kinds of private compliance then occurred in the reward conditions of the experiment, the first being private compliance which was a function of the attractiveness of the group and the second being private compliance which

was initiated by public compliance without private acceptance. This led to more private compliance in low cohesive groups than in high cohesive groups in reward conditions because of the greater readiness of members of low cohesive groups to comply publicly in order to receive the reward. Members of high cohesive groups, because of greater resistance to compliance which was not privately accepted at the time that it occurred, did not comply publicly until the end of the discussion. The reward thus resulted in no increment in the ability of high cohesive groups to influence members privately.

114 pages. \$1.43. MicA54-3205

**AN ANALYSIS OF INDUSTRIAL AND
MILITARY MORALE RESEARCH WITH
IMPLICATIONS FOR ASSESSMENT OF MORALE
ON COLLEGE AND UNIVERSITY CAMPUSES**

(Publication No. 10,085)

Roger Francis Moran, Ed. D.
Syracuse University, 1954

Identification of a conceptual basis for organizing thought and inquiry about campus morale is the problem undertaken in this study.

The study is a bibliographical review and analysis. Three literatures were analyzed to provide a synthesis of facts and ideas about morale to be used in the organization of morale studies in colleges and universities. Research on industrial morale, military morale, and campus life and organization made up the three literatures studied. The campus literature was supplemented by interviews held with members of college and university staffs.

Four main procedural steps were followed: search of the literature, abstraction of morale factors from industrial and military literature, integration and interpretation of campus literature along parallels of deductions from the industrial and military literature and translation of morale factors from industrial and military terms to terms applicable to college and university campuses.

The conclusions of the study embody a synthesized definition of campus morale, classified influences on morale, and asserted interrelationships among morale influences in organizational life. Factors and interactions relevant to morale development on the campus have been listed as bases for the development of questionnaires, scales, checklists, and interview schedules for investigation of morale on the campus.

As conceived in this study, campus morale refers to the level of motivation existing in students, faculty, and administrators to work cooperatively to promote educational and social development of students and to promote extension and dissemination of knowledge.

It is asserted that an upward morale trend may be developed on a campus where all the members are motivated to cooperate in seeking to realize the

institutional goals by participation in the continuing technical and social processes of group life (in a conducive physical and economic environment) which yields to all satisfactions (or self-imposed modifications) of personal needs and aspirations.

The proposed morale factors relate to individual characteristics, commonality of personal and group goals, job requirements, rewards of group membership, work conditions, community conditions, and formal and informal interpersonal associations within and without the immediate institutional organization. These interrelated factors are found to be associated with the motivation of individuals toward institutional goals and, therefore, to morale as conceived in this study.

For researchers interested in morale (particularly campus morale) the study makes available: an extensive bibliography on morale, a compilation of morale definitions, and synthesized summaries of industrial, military, and campus literatures related to morale.

444 pages. \$5.55. MicA54-3206

**THE EFFECT OF ACCEPTANCE AND
REJECTION UPON ATTITUDES AND
PARTICIPATION IN A
LEADERLESS GROUP DISCUSSION**

(Publication No. 10,039)

Herbert William Samenfeld, Ph. D.
University of Minnesota, 1954

Supervisor: Ben Willerman

The purpose of this study was to determine whether feeling accepted or rejected by his group resulted in a person's talking more or less and feeling more or less favorable toward the group. The subjects were assembled in groups of eight to deliberate as a jury and to reach a verdict. Each member was asked to introduce himself to the group, and then was asked to rate each of the others in terms of how well he liked that person. These first impressions formed the rationale for returning falsified information to each person at the half-way point in the discussion. Half of each group were told that they were not so well liked, half that they were well liked by the others.

A comparison was then made of the amount of talking each person did before and after the introduction of the experimental manipulation and of his attitudes toward the situation and the group. The data were examined further to determine whether personality variables might be interacting with the manipulation in producing the effects noted. The main personality variable investigated was the person's self-acceptance as measured by Berger's Scale of Expressed Acceptance of Others.

The data were analysed by categorizing each person's participation in the discussion or his expression of his feelings or attitudes as being in either the top or lower half of his own group's

distribution. These data were collected over all groups and were analysed by chi square.

The following are the main results observed.

1. Acceptance and rejection led to a difference in how much people talked in the discussion, accepted people talking more and rejected people less.

2. There was no relationship between self-acceptance and this effect.

3. Among accepted women, those who did talk more were more masculine in interests, more anxious, less active, more retiring, and less self-accepting than were those who talked less, as measured by scales of the Minnesota Multiphasic Personality Inventory.

4. How well a person felt that he had done in the group was related to how much he had talked.

5. Accepted women were more prone to say that they had done well, that they had done better than in the past, that it was easy to talk, that the group was a pretty good one, and that a given person was friendly. Accepted men were more prone to say that they had done well, and that they would like to remain on the jury.

6. Self-acceptance was related to the attitudes held by rejected women. Those who were low in self-acceptance were more likely to project their feelings and say that the group was not so good.

In conclusion, it may be said that accepting or rejecting a person has an immediate effect upon his participation in a group discussion and upon his attitudes toward the situation. The effect upon his participation is of short duration, although the duration of other effects was not determined.

335 pages. \$4.19. MicA54-3207

SOME DIMENSIONS AND PERSONALITY CORRELATES OF SOCIAL SELF INSIGHT

(Publication No. 9782)

Marjorie Jane Stee, Ph. D.
Cornell University, 1954

The role of Social Self Insight (the individual's awareness of the feelings of others toward him) has been recognized by psychologists and psychotherapists as significant in personality functioning and mental health, for the development of relatedness to one's self and to one's fellow men. Previous investigations of Social Self Insight ability have focused primarily upon the accuracy of the individual in estimating the attitudes of others toward him. These studies of social insight and empathy differ from each other and from the present study in methodology, criteria for accuracy, and/or in the age level studied.

The present investigation seeks to differentiate, at the early adult level, more than one dimension in that measure of Social Self Insight ability which is defined as the difference between predicted and received acceptance responses from particular others, and to discern some of the personality correlates attending variations in these measures.

A pre-test, conducted to search for measures and hypotheses, disclosed two apparently different dimensions in this ability: accuracy and direction of error. Individual scores in these two variables indicated three categories in each. The Accuracy groups were derived from ranked scores divided into three equal levels and termed Most Accurate, Moderately Accurate, and Least Accurate. The Direction of Error categories were determined by the prevailing tendencies in errors of estimate as follows: Under-Estimation, Over-Estimation, and Ambi-Estimation (the last from an almost equal number of both over- and under-estimations).

To discover whether Accuracy and Direction of Error were two independent dimensions and whether variations in these measures were attended by certain personality correlates, a number of structured questionnaires and personality inventories were administered to a sample of 116 college students (70 men and 46 women) from three fraternities and two sororities. The members of each house had become well acquainted through six months of living together.

The data were treated for each sex sample separately and the subjects were compared on the measures of the major variable and the personality characteristics.

Based on the findings of this study, the following conclusions were drawn:

1. This measure of Social Self Insight differentiated two independent although positively related dimensions: Accuracy and Direction of Error.

2. The Ambi-Estimators were significantly more Accurate in Social Self Insight than the Over-Estimators or the male Under-Estimators. Accuracy levels did not differentiate between Ambi- and Under-Estimation for the female group.

3. Except for a greater incidence of Under-Estimators among the women, the sexes were similar on both dimensions of Social Self Insight.

4. Accuracy in Social Self Insight was attended by characteristics indicative of favorable social acceptance and adjustment.

5. The Ambi-Estimators appeared to have superior awareness of the feelings of others toward them.

6. The Under-Estimators evidenced a lower degree of awareness of the feelings of others toward them than the Ambi-Estimators, but were ranked highest by the group on both acceptance and adjustment. Among the women only, the Under-Estimators scored highest in measures of social confidence.

7. The Over-Estimators appeared to have the least awareness of the feelings of others toward them, and to be least accepted and regarded as least well adjusted by the group.

8. Comparison on measures of Conformity from another study of the same population showed that when aware of the group norms, the Under-Estimators were Over-Conforming to them, the Ambi-Estimators were Over- or Moderately-Conforming (in almost equal numbers), whereas the Over-Estimators were unpredictable regarding conformity to group norms.

106 pages. \$1.33. MicA54-3208

SOCIOLOGY

SOCIOLOGY, GENERAL

FAMILY CRISES: AN ANALYTIC STUDY OF PROBLEMS AND CRISES EXPERIENCED DURING A PERIOD OF TWO YEARS BY EIGHTY-ONE MIDDLE-INCOME FAMILIES

(Publication No. 8959)

Frances Marian Bishop, Ph. D.
Washington University, 1954

This dissertation deals with the question of trouble in the broad pattern of American family living. In approaching this problem, four basic questions presented themselves. These were: To what extent do middle-income families experience problems that are outside of the ordinary situations of life? What are these problems and crises encountered? How do the families meet these situations — upon what resources do they rely? And finally, what are the outcomes of these events? This investigation sought the answers to these questions by repeatedly interviewing a sample of middle-income families living in a mid-western urban center. It is upon a reconstruction of the difficulties which they reported as experienced in a two year period that the answers to these questions have been based.

A "family" included a father, a mother, and at least one child. Thus, all broken homes and all childless homes were eliminated, creating a special kind of sample and limiting the kind of crisis situations which were considered. A crisis was thought of as any decisive change which creates a situation for which the habitual patterns of a family are inadequate. This type of operational definition allowed the demands a situation made to be viewed in terms of the attitudes and resources of the individual family.

A majority of the participating families were "parent-centered" with the husband and wife sharing equally in the responsibilities of the home. When children reached their middle teens they shared responsibilities with their parents and were on a more "equalitarian" basis. In a few families one of the adults tended to be the dominant person, taking most of the responsibility for family activities. The findings of the study indicate that these families were faced with difficulties regardless of where control was vested. While all of the families reported minor difficulties, not all reported problems and major crises. Eighty-nine problems and crises were reported by seventy-one families. These problems and crises were either (1) internal within the family group or (2) external difficulties affecting the group but not arising within the unit. The internal difficulties were mainly tensions and disagreements among

family members, e.g., parent-child conflicts; husband-wife disagreements over religion, finances, and so on; and tensions with in-laws and relatives. The external difficulties were situations such as getting re-established in a new city, and financial difficulties arising from an unexpected illness, pregnancy, death, and so forth.

When faced with such difficulties, the participating families reported that they met them mainly through their own efforts. Organized, publicly supported, charitable agencies were unconsulted, for to go to any kind of charitable agency would be an admission of defeat. Relatives were seldom called upon in time of need. Respondents voiced the attitude of not wanting relatives to know they were involved in trouble, and particularly internal trouble.

Regardless of the kinds of resources utilized to meet problems and crises, a majority of the families were able to keep the unit together in a fairly close-knit group. Most families either returned to an approximation of the same degree of unity that was in existence prior to the impact of trouble or else they became a more highly unified family group. A characteristic attitude expressed was one of wanting to meet difficulties themselves and wanting to meet them successfully. In the main, they were able to do so since very few of the difficulties resulted in adverse effects on the unity of the family.

153 pages. \$1.91. MicA54-3209

LOCAL INDUSTRIAL STRUCTURES, ECONOMIC POWER, AND COMMUNITY WELFARE: THIRTY SMALL NEW YORK STATE CITIES: 1930-1950

(Publication No. 9914)

Irving Amio Fowler, Ph. D.
Cornell University, 1954

This study analyzes empirically the ideology of liberal capitalism as it specifically relates to the presumed effects of small- versus big-business on local "welfare." A review of evidence disclosed that small- versus big-business dominance in industrial cities had highly variable effects. The discordance of these findings with ideological expectations left the problem in an indeterminant state and provided a basis for further study.

The test was accomplished by partial replication and extension of the Mills-Ulmer study of small- versus big-business cities. Thirty small New York State cities (10,000 to 80,000) were selected, their industrial and power structures analyzed, and the

association of these structures with an index of welfare was noted in a series of ex post facto experiments.

Small-business cities were found to have no higher levels of welfare than big-business cities; to the contrary, intensive analysis showed small-business cities tended to have low levels of welfare. The "type of industry" was found to be an important criterion for more adequate classification of industrial structures. In the cases studied, heavier durable-goods industry and concentrated employment were associated with higher welfare levels. This study's major conclusion was, therefore, that "concentrations of economic power" do not have invariable adverse effects on community welfare.

An experiment in local power structure analysis produced similar results. The least pluralistic power structures (concentrated employment, low industrial unionism, small "old" middle-class, low political "liberalism," and low population heterogeneity) were associated with higher welfare levels. In light of past evidence of adverse effects of local monolithic power situations, this finding was startling.

These findings were obviously at sharp variance with the Mills-Ulmer study and with ideological expectations. The discordance of the findings with past evidence, which had partially confirmed the ideology, required a complex interpretation of related levels of socio-economic phenomena: (1) the growth pattern of modern industry and its "abuse" of economic power; (2) the defense and protective reactions of specific weaker buyers and sellers as they organized to thwart felt abuses; (3) the intersection of the bargaining relations of "original" and "countervailing" market power holders at diverse geographical and social structural locations; and (4) the convergence of these intersecting relations in local economies and in the aggregate economy.

The interpretation could, therefore, only suggest connections between conditions and processes in the larger political economy and the findings. The different effects of the more general bargaining relations permeated into the communities through the skeletal framework of local industrial and power structures that were abstracted for analysis. In the cases studied, big-business cities had higher welfare for reasons related to its monopolistically competitive and technically advanced nature. They paid higher wages, enhanced local property and tax revenues, stimulated the growth of ancillary industries, and, being forced to bargain with massive retail organizations, contributed indirectly to greater consumer satisfaction. These were likely to be long-term benefits, if the industrial units were newly located and the general economy was stable. But these benefits could be subject to drastic reversals, if the units were obsolescent, the centers of productions were shifting, and technological innovations were imminent.

Important factors in modern situations make it increasingly difficult to "abuse" economic power at all levels of socio-economic life. Among these factors, the following appear significant: the solvent of

increasing wealth; the growth of private neutralizing market power; the growth of public power to protect "public welfare"; and widespread personal resistance to unlimited exercise of all types of social power. In short, the paradoxical finding that local monolithic power was not abusive economically can only be explained by the growing restraints upon it coming from the increasingly pluralistic power in the general social structure.

253 pages. \$3.16. MicA54-3210

AMERICAN VALUE ORIENTATIONS AND THE PREDISPOSITION OF PERSONALITIES TO OCCUPATIONAL ROLES

(Publication No. 9773)

Lawrence Podell, Ph. D.
Cornell University, 1954

The thesis may be said to have three general purposes: (1) it is an exercise in applying certain aspects of the "General Theory of Action" to research operations; (2) it is an attempt to present substantive findings, from the data and sample of the Cornell Student Values Studies of 1950 and 1952, in terms of theoretical considerations contained in an unpublished paper by Dr. Talcott Parsons entitled "Memorandum II: Further Theoretical Considerations for a Study of Social Mobility"; (3) it is an attempt to generate a number of hypotheses for further test by ex post facto interpretations (utilizing Parsons' conceptual scheme) of some of the empirical relationships found in the process of data analysis.

The thesis is concerned with certain American values which are internalized in the personalities of participants in American societies. The participants are thereby motivated to engage in role behavior. These interactions function to implement the values and gratify the need-dispositions of the interacting personalities.

The primary concern of the thesis is with occupational role behavior. An occupational role typology is developed in the thesis. The different occupational role types differentially implement the value system. In addition, there is a "lack of congruence" between the value system and the occupational system. Strains are thereby created in the personality system and typical "deviant" reactions to these strains are discussed. The "deviants" in each of the occupational role types exhibits different traits related to their occupational role behavior.

Typical reactions to typical strains produce a focus upon alternative values. Through the process of socialization, participants internalize these alternative values. The typical adaptations may involve sub-cultural differentiations within the society, incorporating elements of the kinship, occupational, and stratification structures. A number of hypotheses regarding these "adaptive sub-cultures" are discussed in the thesis.

A separate chapter of the thesis is devoted to

female participation in familial and occupational roles. The concluding chapter of the thesis is concerned with the relationship between certain familial and occupational role behaviors, with particular reference to the needs of the personality for security and adequacy gratifications.

212 pages. \$2.65. MicA54-3211

THE FORMULATION AND VERIFICATION OF A THEORY OF PRIMARY SOCIAL INTEGRATION

(Publication No. 9926)

Gilbert Shapiro, Ph. D.
Cornell University, 1954

The theory advanced in this work is intended to contribute to the justification of a number of conjunctive concepts in social science, such as the primary group concept. It is based upon the belief that while concepts cannot have truth-value, they can and must be justified. Three canons of justification are proposed: articulation of the concept with others in current use; significance of the consequences of the conceptualized conjunction; and the lawful rather than fortuitous occurrence of the conjunction. While some attention is paid to the first two canons, the major effort is devoted to the development of a "Theory of Primary Social Integration," which sets forth certain regularities leading to the inference that the terms of the conjunctive concept will tend to vary together.

"Primary integration" is defined as the conjunctive level of four "integrative variables": identification, consensus, interpersonal appraisal, and association. Each of these terms may be used to characterize either a group as a whole or the relation of an individual to a group. In the former case, their conjunction is said to characterize the degree of integration of a group. In the latter case, their conjunction characterizes the integration of an individual in a group. The "Theory of Primary Social Integration" is summarized by the statement that the four integrative variables constitute a determinate system. This means that every variable exerts an influence upon every other. It is evident that the summary statement is shorthand for twelve hypotheses, each of which states that one of the variables influences another.

Part I is devoted to a detailed statement of the theory and its philosophical premises. A symbolic system is developed to transform theoretical statements of causal influences to empirical statements of statistical relationships. With this systematic approach, four statistical tests of the hypothetical system are developed. Part I also contains a detailed discussion of much of the theoretical and empirical literature bearing upon each of the component hypotheses of the theory, and upon the theory as a whole.

Part II describes the empirical data used in the four tests for the existence of a system. Indices of each of the integrative variables are developed from

survey materials collected in a rural New York State community. A Guttman type quasi-scale of identification is developed, and validity tests of the scale types are applied. Consensus is measured in two different ways: as distance from the modal pattern of attitudes in the community and as distance from the pattern of modes. Sociometric scores are tested, and found valid, as measures of association and appraisal-status in the community. Appraisal-status is alternatively measured by prestige ratings made by an anthropological field investigator.

Part III, the four tests, developed by inference from the definition of a determinate system, are applied: an "uncontrolled bivariate test," a "controlled bivariate test," a "quadrivariate rotation test," and a "direction of influences test." The results are as follows: if "consensus" is defined so as to render its appropriate measure the distance from the pattern of modes rather than the modal pattern of attitudes, the data consistently support the theory, according to all four tests. Finally Part III also contains statistical explorations of the structure of the hypothetical system.

427 pages. \$5.34. MicA54-3212

SOCIOLOGY, FAMILY

A STUDY OF THE CHANGES OF DIVORCE LEGISLATION IN THE STATE OF SOUTH CAROLINA

(Publication No. 9679)

John Robert Millar, Jr., Ph. D.
Florida State University, 1954

This study is an attempt to analyze certain aspects of the social changes involved in the divorce legislation of South Carolina between the years 1865-1949. During the years 1878-1948, South Carolina was the only state in the union which refused to grant a divorce on any grounds to its citizens.

The various factors involved in the shifting attitudes toward divorce are examined in detail. An analysis is made of the state's demographic phenomena including a structure of the cultural and social system relevant to an understanding of the folkways, family attitudes, value systems and laws pertaining to divorce in order to discover the part played by public opinion, special interest and/or pressure groups.

Geographic, economic and attitudinal factors were of great significance in the social changes which helped to bring about divorce legislation. In the agrarian milieu characteristic of the state's development from 1670 to the second decade of the present century, there were but few symbiotic relationships with agencies outside the state's border. The predominant attitude toward divorce was similar to that contained in the Biblical writings, which were

held in high regard by a population largely composed of Protestant people. Marriage and family behavior was regulated largely by the unconscious and conservative forms of custom and tradition rather than by legislative laws and courts.

The transition from a rural to an increasingly urban society resulted in complex changes that seriously affected family stability. Social changes incident to two World Wars, as well as urbanism and mobility, created a greater need for legally controlled behavior in family relations. The presence of military personnel in urban centers, the returning veteran and migratory divorce created a cultural multivalence which demanded legislation granting divorces to incompatible couples.

For five decades conservative legislators resisted any change in the 1895 constitutional ban on divorce, basing their objections on religious grounds and "state pride." When a resolution was introduced in the General Assembly in 1947 to permit the people to vote in a statewide referendum on the divorce amendment, a sufficient majority approved and, in 1948, the amendment passed by a significant vote of the people. It was ratified by the Legislature in 1949. The most significant factor about the enactment of this law was that its adoption resulted not so much from the influence of organized groups as from a growing awareness of a deep social need.

108 pages. \$1.35. MicA54-3213

SOCIOLOGY, PUBLIC WELFARE

A SOCIOLOGICAL ANALYSIS OF LAND TENURE PATTERNS IN LATIN AMERICA

(Publication No. 9561)

Sam Schulman, Ph. D.
University of Florida, 1954

The bulk of Latin America's people derive their sustenance and livelihood from the land. They do so as either farm operators or farm laborers, the two major tenurial classifications. Of the operators, some own, some rent, and some enjoy no legal title to the land they farm. Of the laborers, some receive their compensation in the form of wages, some in a percentage of the crop-yield, some in the temporary usufruct of a parcel of land; many are compensated in combinations of these three forms of payment. A great many agricultural workers, members of the families of either operators or laborers, receive no compensation for their services at all.

Most persons in Latin America involved in agricultural production are farm laborers who enjoy no rights in the land they farm.

Rights in the land stem from two sources; the indigenous systems of land tenure, and the medieval Iberian systems of land tenure. Except for the persistence of communal tenure among Indian communities in some parts of Latin America, and for specific rights in land reserved to the state, land is held today in virtual fee simple, and this has been true throughout the four centuries of Latin America's recent history.

420 pages. \$5.35. MicA54-3214

SPEECH - THEATER

RELATIONSHIPS BETWEEN THE PRINCIPLES OF ACTING AND RHETORICAL DELIVERY IN EIGHTEENTH-CENTURY ENGLAND

(Publication No. 9023)

William Wall Adams, Ph. D.
University of Illinois, 1954

This study attempts to discover the relationships between the principles of acting and those of rhetorical delivery in England during the eighteenth century, and to discover whether or not the bases of such relationships belong to any significant extent within the matrix of thought and idea which generally dominated the era. Since the study is intended as a contribution mainly in the field of acting, it presents a detailed examination of the evolution of the histrionic art, including both theory and practice; it is not intended to include a detailed study of the entire body of rhetorical theory, but rather to present an account of the major developments in the theory of oral pre-

sentation of public address in order to report the significant relationships between the two arts.

The study is based mainly on primary sources: newspaper articles, journals, letters, essays, treatises and drill manuals, histories, and biographies of the period. The secondary sources used include modern treatises, evaluations, histories, and biographies. Memoirs of actors and critical reviews of performances of these actors were consulted to determine the relationship between the theory and the practice of acting.

Chapter I presents a summary of dominant eighteenth-century ideas and attitudes. Chapter II treats summarily the major pronouncements on the importance of a "good delivery" in public address, and traces the development of the "rules and regulations" considered essential for the practice of "effective public speaking." Since the eighteenth century produced a number of distinct "styles" of acting, Chapter III describes the theory and practice of acting on the basis of "schools" which were founded

by the leading actor-managers, each of whom attempted to teach and direct his company of actors in his own style. The discussion of the "styles" of acting, established by the Betterton school, the Cibber-Wilks-Booth school, the Macklin-Garrick school, and the Kemble school, takes into account the general influences of the age and the personalities of the founders. Chapter IV summarizes the relationships between the principles of acting and of rhetorical delivery.

This study reveals that evolution of the principles of the art of acting and of the art of public address in the eighteenth century reflects the scientific spirit of the age, which assumed that through the observation of nature and the exercise of reason the truth could be ascertained in all fields of knowledge and success could be achieved in all fields of action. Hence the rules and systems of expression which were developed in both arts. Changing ideas of nature and of the function of reason were major factors in the changing pattern of theory and practice in both arts.

To the extent that theory and practice in both arts was based upon accurate and adequate observation of expression in ordinary life, a natural style of acting and of speaking appeared. To the extent that the results of observation were modified by considerations of propriety, grace, beauty, or startling effect, acting and speaking became artificial. On the whole, in the early part of the century, a restrained and greatly restricted naturalism predominated. This degenerated into an exaggeration far removed from the natural. It was replaced by a style which, though lacking much in naturalism by modern standards, yet aimed at conversational speech and natural movement. This in turn was supplanted by a grand style in which naturalness was overshadowed by considerations of beauty, grace, and dignity.

During the first three-quarters of the century, acting appears to have exercised the dominant influence on public address, and during the last quarter of the century public address appears to have exercised the dominant influence on acting.

146 pages. \$1.83. MicA54-3215

**A COMPARATIVE STUDY OF THE BREATHING
AND SPEECH COORDINATIONS OF
LARYNGECTOMIZED AND NORMAL SUBJECTS,
INCLUDING AN EVALUATION OF THE
RELATIONSHIPS BETWEEN THE BREATHING
AND SPEECH COORDINATIONS OF THE
LARYNGECTOMIZED AND THEIR
JUDGED INTELLIGIBILITY**

(Publication No. 8171)

Walter W. Amster, Ph. D.
Syracuse University, 1954

This study was designed to compare the breathing and speech coordinations and judged speech intelligibility of fifteen normal, and fifteen laryngec-

tomized speakers who were not employing artificial larynx for communication. The groups were comparable in mean age and age range.

The hypotheses examined were: laryngectomized speakers essentially continue normal breathing and speech coordinations and that speakers judged more intelligible would approximate more closely normal coordinations than those judged less intelligible.

A custom-built, motor-driven variable speed kymograph was utilized in securing breathing and speech coordination data. Tracings of the movements of the body wall at the lower sternum and mesogastric areas during silence and speech were secured for both groups. Syllable pulse tracings were recorded during speech. Each speaker spoke the same five-, seven-, and nine-syllable phrases and sixty-syllable paragraph.

Measurements of silent breathing included breathing cycles per minute and amplitude of the chest and abdominal tracings. The speech tracings were measured for total time in speaking the phrase and paragraph, number of phrases and amplitude of abdominal and chest excursions.

High fidelity tape recordings were made for each laryngectomized subject while speaking different sets of fifty monosyllabic words (P. B.), Haagen's Multiple Choice Intelligibility Tests, and ten unrelated sentences varying in number of syllables. The recordings were audited by groups of speech pathology and audiology majors. An intelligibility score for each index and a combined intelligibility score was computed for each speaker.

Rhythm analysis of the 150 sentences spoken by the laryngectomized speakers was completed, and cinefluorographic film views were made for five laryngectomized and one normal speaker.

Results

1. Silent Breathing

The laryngectomized speakers differed significantly from the normal group, exhibiting greater number of breathing cycles per minute and having greater chest amplitude. Kymograph configuration patterns for both groups, however, revealed marked similarity.

2. Speech Breathing

The laryngectomized speakers differed significantly from the normal group exhibiting greater total time and number of phrases in speaking. Chest and abdominal amplitude measurements for the sixty-syllable paragraph revealed no significant differences between groups.

3. Kymograph tracings, distributions of predictor scores (total time, number of phrases, rhythm) and the cinefluorographic film views revealed laryngectomized speakers judged most intelligible approached the speech coordinations of normal subjects more closely than those judged less intelligible.

4. The predictors of intelligibility contributing the greatest percentage of predictable variance proved to be rhythm, time, and phrases, with rhythm providing the greatest percentage of predictable variance for one predictor. The combination of

rhythm-time-phrases with sentences offered the greatest percentage of predictable variance for the entire correlation data.

5. The laryngectomized speakers did not disassociate respiration and phonation. For the speakers judged low in intelligibility there was some evidence of breakdown of speech coordinations which reduced the efficiency of the respiration-phonation process.

6. There was evidence of synchrony of inspiratory and expiratory phases of respiration for high intelligibility speakers in both gross and small detail. Definite dysynchrony was revealed for low intelligibility speakers.

7. The cinefluorographic film views indicated:

- a. High intelligibility speakers did not appear to employ swallowing behavior. Intake of air was limited to the proximal portion of the esophagus. The site of the pseudo-glottis appeared to be a small narrow vibrating portion of the esophagus in the approximate region of the reconstructed crico-pharyngeal sphincter.
- b. Low intelligibility speakers revealed decided swallowing behavior which propelled air into medial portion of esophagus with some escape into stomach. The pseudo-glottis appeared to occupy a relatively larger vibrating portion of the esophagus extending below the reconstructed crico-pharyngeal sphincter.

Results of the study suggest a satisfactory program of voice retraining may be evolved on the basis that normal speech coordinations continue and should be continued after laryngectomy. The laryngectomized speaker should be taught to intake air without conscious swallowing-behavior if possible. Retraining procedures should facilitate and expedite more rapid production of speech based on refinement of speech-breathing coordinations and voice production with attention to rhythm and phrasing units prior to development of communicative speech.

270 pages. \$3.38. MicA54-3216

THE PULPIT SPEAKING OF DWIGHT L. MOODY

(Publication No. 9861)

Richard Kenneth Curtis, Ph. D.
Purdue University, 1954

Major Professor: N. B. Beck

In 1873, Dwight Lyman Moody, a young lay evangelist known little outside the confines of Chicago, arrived in Liverpool, England. Before leaving England two years later he had spiraled into a pulpit speaker of world renown. For twenty-five years he continued to gather huge audiences before him, until, disregarding doctors' orders, he collapsed before twelve thousand people in Kansas City, and died within a month.

This paper, an attempt to analyze Moody as a pulpit speaker, is done in terms of the four generally

recognized constituents of the speaking situation: speaker, occasion, subject, and audience. The historical-rhetorical method was used, together with intensive quantitative analysis. The following data comprise a brief summary of the evidence examined.

Having received virtually nothing of formal speech training, Moody found, in selling shoes, informal debating, and working with the Young Men's Christian Association, as well as the Sunday School, ample opportunity for informal speech self-training. The immediate speech situation, viewed as the most important part of the occasion, was carefully planned by Moody and proved a major factor in his success as a pulpit speaker. Moody drew his sermon material from four major sources: the Bible, experience and observation, conversation and discussion, and other literature, listed in their descending order of frequency in his sermons. "Sponging" the best information from the sources with which he came in contact, Moody arranged it into a rather haphazard sermon form, scrawled it on paper and took it into the pulpit fastened next to the Bible text by elastic bands. Then, with a strictly functional choice of words, Moody, the businessman-preacher, sought as directly as possible to lift the unconverted elements of his audience from their seats and garner them into the "inquiry room," there to "sign on the dotted line" for his Christ.

One of Moody's strongest assets in accomplishing this was his delivery. Though his bodily movement and rate of utterance were comparatively calm most of the time, Moody was capable of both amazing speed of utterance and dramatic histrionics when warmed to a particular subject. His voice, usually a loud, distinct, husky tenor, was generally noted for its naturalness, earnestness, and directness by his critics.

The majority of a representative audience of Moody's consisting of the lower, working classes, came to hear Moody from motives of duty, love for Christ and others, loyalty to a church, curiosity, gregariousness, or desire for entertainment. Coming from the lower classes himself, Moody was peculiarly fitted to adapt himself to his audiences. This he did, although seldom, if ever, by compromising what he considered to be the truth.

Long-range effects of Moody's pulpit speaking included: (1) thousands of converts; (2) a revival of Christianity as a whole; (3) higher community morale; (4) renewed inspiration of clerical and lay leaders; (5) increased good-will between Great Britain and the United States, as well as the North and the South; (6) the founding and maintenance of several institutions and organizations; (7) greater prestige for religion as a whole and evangelical Christianity in particular; (8) the enlistment of the secular press on behalf of Christianity; (9) the continued popularity of his sermons.

From the evidence, the following conclusions appear to be warranted:

1. Dwight L. Moody was one of the most effective pulpit speakers of the nineteenth century.
2. The effect of his preaching is still felt across the English speaking world.

3. Moody's success as a preacher resulted more from his use of audience psychology and persuasive techniques, his sincerity, and his effective delivery than from the logical reasoning and structure of his sermons.

458 pages. \$5.73. MicA54-3217

AN ANALYSIS OF THE PITCH AND DURATION CHARACTERISTICS OF THE SPEECH OF CEREBRAL PALSIED INDIVIDUALS

(Publication No. 9863)

Robert Francis Duffey, Ph. D.
Purdue University, 1954

Major Professor: T. D. Hanley

To carry out a descriptive and exploratory study of two speech characteristics of cerebral palsied individuals, recorded in reading and speaking, samples were collected from 158 subjects who met a minimal standard of intelligibility. The recordings were made at various treatment centers in the United States and later were evaluated in the laboratory for a final selection of the samples most suitable for pitch and duration analyses. After evaluation the recordings of 32 athetoids and 26 spastics were converted to graphic recordings of fundamental frequency by means of the Purdue Pitch Meter, an electronic period timer, a cathode ray oscillograph and an oscillograph motion picture camera. With the aid of delineascopic projection the continuous film representations of fundamental frequency were measured to compile quantified distributions in pitch and duration units for each individual in both reading and speaking performances. From the basic distributions of data, standard measures of pitch and time were calculated. The fourteen measures for analysis of data included the central tendency and indices of variability of pitch, the central tendency for duration of phonation, an index of proportionality relating duration of phonation to duration of total speech sample, and the rate of word production. With the original sample subdivided into athetoid and spastic cerebral palsy types, three age levels, the two sexes, and reading and speaking performances, comparative analyses of the data were attempted. Since only descriptive trends were sought, and since many of the assumptions involved in the application of statistical tests of significance could not be met, the statistical treatment consisted of the calculation of arithmetic means only. Results were reported on the basis of trends observed by inspection of the tables of means.

Within the stringent limitations imposed by the lack of statistical control, as well as sources of error attributable to instrumentation, selection of subjects, and failure to match groups with respect to severity of speech handicap, the following conclusions are offered to the end that future investigations under more carefully controlled conditions, may follow up the trends observed:

1. Cerebral palsy groups consisting of athetoid subjects apparently are distinguishable from groups consisting of spastic subjects on the basis of pitch differences. Specifically:

- slightly lower pitch levels are noted for spastic than for athetoid groups,
- larger standard deviations of individual pitch distributions are noted for athetoid than for spastic groups,
- larger total pitch ranges are noted for athetoid than for spastic groups,
- larger functional pitch ranges are noted for athetoid than for spastic groups,
- larger upward and downward shifts in pitch are noted for athetoid than for spastic groups, and
- faster rates of pitch modulation are noted for athetoid than for spastic groups.

The generalizations listed above are based principally on the most stable of the subgroup data, the results from the analyses of the adults' reading and speaking samples.

2. Age groupings and sex groupings with respect to the pitch measures contribute to distinguishing characteristics of athetoid and spastic speech, while analyses of speaking performance usually differ only in degree rather than kind from analyses of reading performance.

3. Cerebral palsy groups consisting of athetoid subjects apparently are distinguishable from groups consisting of spastic subjects on the basis of time differences. Specifically:

- slightly faster reading rates are noted for athetoid than for spastic groups, and
- faster within-sentence rates are noted for athetoid than for spastic groups.

The two rate generalizations are based on the data from the adult subgroups.

4. Age groupings and sex groupings with respect to the time measures contribute to distinguishing characteristics of athetoid and spastic speech, and results from analyses of speaking performance tend usually to confirm results found in analyses of reading performance.

133 pages. \$1.66. MicA54-3218

THE EFFECT OF FREQUENCY FILTERING ON CONSONANT RECOGNITION

(Publication No. 9873)

James David Lambert, Ph. D.
Purdue University, 1954

Major Professor: M. D. Steer

An investigation was designed to study the effects of frequency filtering upon the recognition of certain consonant sounds when those sounds are uninfluenced by other speech sounds. Specifically, the study was designed to answer the following questions:

- Will the elimination of certain frequencies

below 2000 cps result in lowered recognition scores for the consonant sounds of English?

2. Will the elimination of certain frequencies above 2000 cps result in lowered recognition scores for the consonant sounds of English?

3. Will such filtering affect different sounds differently, i.e. will stop consonants be affected differently from fricative consonants; will there be differences within the stop and fricative groups?

4. Where the removal of frequencies from the spectrum results in a reduced ability to recognize the consonant sounds, what substitutions are most likely to occur?

Six stop consonants [p, b, t, d, k, g] and nine fricative consonants [f, v, s, z, tʃ, dʒ, ʃ, θ, ð], were combined with the neutral vowel [ʌ] so as to form fifteen nonsense syllables of the CV type. These fifteen syllables were recorded by a young male adult who had normal voice quality and articulation. Using these fifteen syllables and by means of a process of dubbing, cutting, and splicing tapes, four lists of seventy-five randomly presented syllables were constructed. These lists were then read to forty young college adults with normal speech and hearing who recorded the consonants they heard. Ten conditions of filtering were employed - high-pass 1000, 1200, 1500, 1700, and 2000 cps and low-pass 1000, 1200, 1500, 1700, and 2000 cps. The results were analyzed for the effects of the various filter levels, for differences in their effect upon the sub-sets of consonants, and for their effect upon specific sounds. The substitutions made for sounds mis-identified were inspected for pattern of substitution related to filter effect.

Within the limits set by the experimental procedure and the techniques of analysis used, the following conclusions are drawn:

1. When all the frequencies above 2000 cps are present, the loss of frequencies below that level has little, if any, effect upon the recognition of the sounds [k, g, f, s, z, ʃ, tʃ, dʒ, θ].

2. When all the frequencies below 1500 cps are present, the loss of frequencies above that level has little, if any, effect upon the recognition of the sounds [k, g, ʃ, tʃ, dʒ].

3. The range of frequencies of primary importance in the recognition of the sounds [k, g, f, s, z, ʃ, tʃ, dʒ, θ] lies above 1500 cps.

4. The recognition of the stop consonants [k] and [g] and of the fricative consonants [tʃ], [dʒ] and initial [v], which might be described as "stop-like," is materially affected by the loss of frequencies below 1500 cps.

5. The loss of frequencies above 2000 cps results in a greater proportion of errors among the voiced sounds than among the voiceless sounds but shows a tendency for sounds of like quality to be substituted for the voiced and the voiceless sounds.

6. Loss of the frequencies below 2000 cps shows no preponderance of errors among the sounds of either class but does indicate a greater tendency for a voiced sound to be substituted regardless of the type of sound missed.

131 pages. \$1.64. MicA54-3219

AN INVESTIGATION OF THE ADAPTATION PHENOMENON AND CERTAIN CONCOMITANT VOICE ALTERATIONS IN STUTTERERS AND NON-STUTTERERS

(Publication No. 9874)

William Raymond Leith, Ph. D.
Purdue University, 1954

Major Professor: M. D. Steer

The purpose of this investigation was to determine whether certain alterations occur in phonation/time ratio, total reading time, pitch, and intensity concomitant with the adaptation phenomenon in stutterers and non-stutterers. The following hypotheses were tested:

1. There is no alteration in the phonation/time ratio manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.
2. There is no alteration in the total reading time manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.
3. There is no alteration in the median pitch level manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.
4. There is no alteration in the pitch variability manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.
5. There is no alteration in the mean intensity level manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.
6. There is no alteration in the intensity variability manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.

The investigation employed 14 male stutterers and 14 male non-stutterers as subjects. Most of the 14 stutterers were receiving therapy at the Purdue Speech and Hearing Clinic although this was not one of the criteria for the selection of the stuttering sample. The 14 non-stutterers were all enrolled in beginning speech classes at Purdue University.

Subjects were seated one at a time in a sound-treated room before an audience of four persons, i.e. three female observers and the experimenter. After being instructed concerning recording procedure, the subject was signaled to read a 200 word passage five times. There was a five second silent interval between each reading. Three trained judges evaluated the recordings with reference to the number of non-fluencies noted in each reading.

The five readings of the various subjects were analyzed for phonation/time ratio, total reading time,

pitch level, pitch variability, intensity level, and intensity variability. A Purdue Speech Sound Timer was employed to obtain the phonation/time ratio and the total reading time. The pitch level and variability were determined by means of the Purdue Fundamental Frequency Recorder of Complex Sounds. A Sound Apparatus Company HPL-E High Speed Level Recorder yielded the information pertaining to intensity level and intensity variability. An analysis of variance was applied to the above data.

Limited to the conditions of this investigation, the following conclusions are offered:

1. There is no statistically significant alteration of the phonation/time ratio, intensity level, and intensity variability manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.
2. There is no statistically significant alteration of the median pitch level and the pitch variability manifested by the stutterers in this study concomitant with the adaptation phenomenon.
3. There is a statistically significant alteration of the median pitch level and the pitch variability manifested by the non-stutterers in this study concomitant with the adaptation phenomenon.
4. There is a statistically significant alteration of the total reading time independently manifested by the stutterers and the non-stutterers in this study concomitant with the adaptation phenomenon.

103 pages. \$1.29. MicA54-3220

AN EXPERIMENTAL STUDY OF THE
EFFECTS ON THE LISTENER OF
ANTI-CLIMAX ORDER AND AUTHORITY IN
AN ARGUMENTATIVE SPEECH

(Publication No. 9622)

Donald Elwyn Sikkink, Ph. D.
University of Minnesota, 1954

Adviser: Howard Gilkinson

This investigation was concerned with factors in the composition of a speech which may influence its effectiveness. Two factors in speech composition were studied:

1. Order of Arrangement of Arguments: Anti-Climax Order of Presentation
2. Enforcement of Ideas: Quotations from Authorities

Previous research has dealt with these factors separately and has measured only the immediate effectiveness of each factor. Such research has produced significant differences and trends indicating that anti-climax order is superior to climax order and that quotations from authorities are effective. The present investigation combined these two factors into one presentation and measured their immediate and delayed effectiveness.

Specifically the purpose was to determine whether a college audience registers immediately and ten

weeks later a greater shift of attitude, more retention, and higher convincingness ratings for speeches containing anti-climax order of arrangement of arguments and authority quotations than for speeches not containing these factors.

A thirteen minute speech on "Voting at Eighteen" was written. The speech contained three arguments which had been ranked for importance. The amount of space given to each argument was proportional to its rank. Each argument was supported by example, statistics, and analogy. In addition six authority quotations from persons of prestige and expertness were used to support the arguments.

Four tape recordings of the speech were prepared. In the first recording the arguments were in anti-climax order (large argument, medium argument, small argument) and contained the names of the authorities (anti-climax authority presentation). The second recording was made in climax order (small argument, medium argument, large argument) and contained the names of the authorities (climax-authority presentation). The third recording was made in anti-climax order and with the names of the authorities deleted. Care had been taken in writing the speech so these names and identifying remarks could be removed without destroying the meaning of the speech (anti-climax non-authority presentation). The last recording was made in climax order and with the names of the authorities deleted (climax non-authority presentation).

The speeches were played to four matched audiences of equal size. The subjects were beginning college speech students and were matched on sex, initial attitude, and college grade average. One week prior to hearing the speech, audience members had indicated their attitude on the question of "Voting at Eighteen" by using a five point rating scale running from (1) "Strongly Disagree" to (5) "Strongly Agree." After hearing the speech, subjects again indicated their attitude, completed a forty-six item true-false test based on the material in the speech, and rated the speech for convincingness on a nine point scale. Ten weeks later the subjects again indicated their attitude, completed the retention test, and rated the speech for convincingness.

Results:

1. There were no significant differences between the four forms of presentation on audience attitude scores, retention scores, or convincingness ratings, immediately upon hearing the speech nor ten weeks later.

The results of the investigation do not support previous research on anti-climax order and authority presentation. As a result the author suggests that anti-climax order and authority do not operate as universal rules of rhetoric. Rather their effectiveness may depend upon the particular speaker, audience, or subject. Further research may reveal under what specific conditions authority and anti-climax order presentation increase the effectiveness of a communication.

100 pages. \$1.25. MicA54-3221

DETERMINATION OF SEVERITY OF
STUTTERING AND CONSTRUCTION OF
AN AUDIO-VISUAL SCALE

(Publication No. 9896)

Harold Benjamin Starbuck, Ph. D.
Purdue University, 1954

Major Professor: Mack D. Steer

This experiment was designed for the purpose of constructing an audio-visual scale for the severity of stuttering. A review of the literature revealed that such a scale had never been developed. An effort was also made to determine which characteristics associated with stuttering were most highly related to severity, i.e. which characteristics make the greatest contribution to an evaluation of severity.

Sound motion picture films were produced presenting twenty-seven stutterers (23 male and 4 female) in a reading-speaking situation. The filmed sample of each subject was then presented to sixteen judges for severity evaluation by the method of paired comparisons. Data were then obtained which made it possible to place the subjects, in an order of severity, along a continuum from least severe to most severe. A final audio-visual severity scale was then constructed containing representative samples for five intervals along the continuum. The scale intervals from least severe to most severe were numbered, one to five successively. To the extent that the subjects in this study were representative of the general population of stutterers, the labels very mild, mild, average, moderately severe, and severe may be applied to the numbered intervals one to five respectively. The representative samples were shown to be statistically significantly alike within intervals, and significantly different from samples in other intervals.

The characteristics associated with stuttering were then counted for each of the original twenty-seven subjects by three judges. Data were collected and correlated with severity by means of the Wherry-Doolittle test selection method. Of the eighteen characteristics considered, seven were selected which gave a maximum multiple correlation ($r = .97$). The seven variables (characteristics) in order of selection were (a) total words spoken, (b) number of blocks, (c) facial grimace, (d) leg and/or foot movement, (e) eye blink, shift, or close, (f) breathing disturbance, and (g) circumlocutions. The amount of increase each variable contributed to the multiple correlation was statistically significant for all variables with the exception of (f) and (g).

In addition to construction of the audio-visual scale for severity of stuttering, another conclusion obtained from this study was that both audible and visible characteristics associated with stuttering are important to the evaluation of severity of stuttering. Statistical significance demonstrated within intervals and between intervals indicated that the scale may be applied validly as a training aid, for diagnostic classification, and for research purposes.

107 pages. \$1.34. MicA54-3222

ORAL AND NASAL SOUND PRESSURE
LEVELS AS RELATED TO
JUDGED SEVERITY OF NASALITY

(Publication No. 9902)

Arthur I. Weiss, Ph. D.
Purdue University, 1954

Major Professor: T. D. Hanley

The purpose of this study was to investigate the relationship of oral and nasal sound pressure levels to judged severity of nasality. In order to complete this task seventeen subjects, who had been previously diagnosed by experienced speech clinicians as having hypernasal voice quality of various degrees of severity, were required to read a 161 word speech-test selection. Two separate but simultaneous tape recordings of the subject's speech were made during the reading. One recording employed instrumentation which utilized a probe-tube microphone, inserted into one of the subject's nostrils, and a high fidelity tape recorder and associated amplifier system. The other recording employed an Altec microphone, placed eight inches in front of the subject's mouth, and a high fidelity tape recorder.

A high speed power level recorder was used to secure a permanent continuous record of the variations in intensity of the two speech samples for each subject. The mean sound pressure level of the nasal speech sample and the mean sound pressure level of the oral speech sample (obtained by the use of the Altec microphone system) were computed from the graphic record of the variations in intensity. These were then equated to compensate for differences in response of the two recording systems.

Fourteen experienced speech clinicians constituted a panel of judges who, using the method of paired comparisons, judged the severity of the hypernasality displayed in the tape recording of the oral speech samples. Scaled severity scores were computed from these judgments. The estimate of average intercorrelation of judges was found to be .861 and the estimate of the reliability of the scaled severity scores was .989.

Pearson product-moment coefficients of correlation were computed for various combinations of the criterion variables, i.e., the scaled severity scores and the mean sound pressure levels of the nasal and oral speech samples.

Within the limitations imposed by the experimental procedure, the following conclusions from this study seem warranted:

1. A marked positive correlation between the judged severity of hypernasality and sound pressure level in the nasal meatus is indicated by the obtained coefficient of + .741.
2. A substantial negative correlation between the judged severity of hypernasality and sound pressure level of the total speech production is indicated by the obtained coefficient of -.574.
3. A very strong relationship between the judged severity of hypernasality and some combination of the nasal and total speech sound pressure

levels is indicated by the obtained coefficient of + .955.

4. A very high positive correlation between the judged severity of hypernasality and the difference between nasal and total speech sound pressure level is indicated by the obtained coefficient of + .948.

5. A very high positive correlation between the judged severity of hypernasality and a direct ratio of the nasal and total speech sound pressure levels is indicated by the obtained coefficient of + .908.

113 pages. \$1.41. MicA54-3223

ZOOLOGY

THE BEHAVIOR OF THE CANADA GOOSE
(*BRANTA CANADENSIS*) IN MANITOBA

(Publication No. 9171)

Ronald Walter Balham, Ph. D.
University of Missouri, 1954

A three-year study has been made of the Canada goose on its summer range, with special emphasis on the breeding behavior and social relationships of members of marked flocks.

Families were still intact prior to establishment of nesting territories by the adults. Most of the sub-adult, non-breeding yearlings left their parents at this time and formed a flock which remained intact several weeks after the new young appeared. The flock then disbanded, and the yearlings rejoined their respective families, in late summer.

Some pairing of yearlings was believed to have occurred, and a small percentage of geese nested as two-year-olds.

Copulation among pairs which had nested the previous year was not seen, and probably occurs in migrants before their arrival; copulation among newly-formed pairs and yearlings was frequently observed.

An intensive study of the behavior of the incubating goose was made. The established pairs from the previous season started nesting three to four weeks before newly-formed pairs, and used the same nest sites as the previous year.

The territory included the nest, its surroundings, and a waiting place for the male. The maximum area was held when incubation began, and decreased progressively thereafter; it ceased to exist after the young had left the nest. The male defended the territory against intruding geese of either sex. His response to intrusion varied greatly, not only as a result of the different releaser values displayed by an opponent, but as a result of the different levels of the threshold of the fighting reaction.

Aggressive behavior against intruders in territorial defense appears to have two functions: (1) to prevent disturbance of the incubating female; and (2) to provide social stimulation between the pair. The social displays, often mutual, resulting from defense activity, maintain and heighten the emotional tone of the pair. The stimulation provided by fighting intensifies the urge to incubate. Displacement activities, such as preening and drinking, are particularly evident following a disturbance.

One case of reneesting after an interval of 11 days was recorded. It was the result of eggs frozen early in incubation and early in the season (mid-April); in four nests lost in late May, after 20 days of incubation, no reneesting took place.

Within their own territory the occupying pair was dominant over all other geese. The social releasers important in defense are discussed. The preservation of family coherence is probably the prime function of encounters within the flock. Contact frequency was primarily a function of proximity and secondarily dependent upon general activity, being higher when the birds were feeding or moving than when at rest. A definite hierarchial system prevailed within the flock, and the dominance was as follows: family > paired adults without young > non-paired adults and yearlings > unattached juveniles. Further, the families with the earliest hatched young were dominant over later families.

The female was the leader of the family during the first three weeks, but after flight was attained the male usually initiated both the pre-flight ceremony and flight.

Local families formed into a flock prior to undergoing the molt; later strange families flew in. Upon arrival, they were recognized as strangers and were kept at the periphery of the flock for several days prior to being incorporated.

Mechanisms for flock integration include socially facilitated behavior and the following reaction, intention movements, and some means by which the duration of the molt is synchronized to enable the flock to first fly as a unit - some birds remained on the ground for 16 days after wing-molt was complete. Family unity persisted after flight was attained.

244 pages. \$3.05. MicA54-3224

A STEROID GROWTH REQUIREMENT
FOR *PARAMECIUM AURELIA*

(Publication No. 10,141)

Robert Louis Conner, Ph. D.
Indiana University, 1954

A steroid fraction obtained from lemon juice was found to be an essential metabolite for *Paramecium aurelia*, var. 4, stock 51.7(s) in axenic culture. This

steroid is closely related to, or is identical with either β -sitosterol or γ -sitosterol.

A study of the relationship between molecular configuration and biological activity revealed that out of the eighty steroids tested only the following possessed growth-promoting activity: brassicasterol, brassicasteryl acetate, β - and γ -sitosterol, fucosterol, poriferasterol, α -spinasterol, stigmasterol, stigmasteryl acetate, α -spinastanol, stigmastadienone.

On the basis of these results certain conclusions may be drawn: (a) methyl or ethyl substitution at carbon 24 is necessary for activity, (b) a double bond at carbon 22-23 increases activity, (c) only one double bond can be present in the nucleus, this may be either in the 5 or 7 position, (d) optical isomerism at carbon 24 does not influence activity, (e) degradation of the side chain results in loss of biological activity for this organism, (f) oxidation of the ring system destroys activity.

The specificity of these requirements suggests that the active steroids function as essential metabolites for this organism.

58 pages. \$1.00. MicA54-3225

STUDIES ON THE NUTRITION OF THE FRESH WATER CRUSTACEAN, *DAPHNIA magna*

(Publication No. 10,068)

LeRoy Thomas Davis, Ph. D.
Syracuse University, 1954

A review of the literature reveals a surprising lack of information on the nutritional requirements of the Crustaceans. This study was undertaken in an effort to elucidate the nutritional physiology of the fresh water crustacean, *Daphnia magna*.

The original clones were obtained from Dr. B. G. Anderson. The animals have been reared in four liter, large mouthed jars containing Banta's horse manure infusion (1921) diluted 1-4 or 1-5 with pond water.

A synthetic pond water described by Allee et al. (1936) was utilized for washing the animals before experimentation to reduce bacterial count. After washing the animals were transferred to the desired culture medium to which 15,000 units of penicillin G (Merck) and .01 mg. of streptomycin sulfate (Merck) were added per ml. Serial transfers under ultra violet light during the course of the culture experiments maintained bacterial counts at a minimum.

Thirty different synthetic media were employed in these studies. The most promising culture medium exploited was one containing a vitamin and growth factor block, a protein source, carbohydrate source, and a purine and pyrimidine source. This was made up with autoclaved unfiltered pond water. This medium maintained the animals for four generations and a total elapsed time of seventy-three days.

This medium made with distilled water did not

prove as satisfactory nor did adding particulate matter such as coagulated egg yolk and other materials improve the medium.

In an effort to ascertain which of the many compounds presented to the *Daphnia* were actually metabolized, a method was devised for measuring the utilization of individual compounds. It was hypothesized that carbon sources, if utilized from solution, should have a sparing effect upon the nitrogen excretion of these animals.

The *Daphnia* were first washed in synthetic pond water and then placed in a solution containing an individual organic compound and antibiotic. Samples were removed at a designated time and analyzed for ammonium nitrogen using the Conway microdiffusion method. Of the numerous compounds tested by this method, only glucose and ethanol indicated a nitrogen sparing effect (i.e., utilization).

Since it is not expedient to test for the utilization of all types of compounds (nitrogenous) with the above method, substances containing radioactive carbon (C^{14}) were employed.

The following compounds were tested:

1. Uniformly labeled C^{14} glucose.
2. Sodium butyrate-1- C^{14} .
3. Glycine-2- C^{14} .
4. DL-glutamic-1- C^{14} acid.
5. Sodium acetate-1- C^{14} .

The first group of experiments were conducted in large flasks containing 40 ml. of radioactive solution at a concentration of 0.2 mg. per ml. for glucose, 0.161 μ g. per ml. for acetate and 0.15 mg. per ml. for the remaining three compounds. The animals were washed in synthetic pond water and placed in the test solution containing antibiotics for the experimental period of twenty hours. CO_2 was absorbed in saturated NaOH and precipitated as $BaCO_3$ for analysis. The animals were removed at the end of the experiment, washed for several hours and dried on planchets for analysis.

The results indicate that glucose, butyrate and glutamic acid are utilized to a greater degree than are acetate or glycine. The data also suggests that the glycine is incorporated into the animal to a greater degree than are the other compounds.

The second group of experiments were conducted to ascertain whether an optimum concentration of acetate, butyrate, glycine and glutamic acid existed. The concentration of acetate ranged from 0.215 μ g./ml. to 1.075 μ g./ml. and the concentrations of the other compounds was from 0.05 mg./ml. to 0.25 mg./ml. The results indicate the animals incorporate more material at higher concentrations, and only glutamic acid seems to be utilized to an extent dependent upon the concentration in solution.

58 pages. \$1.00. MicA54-3226

THE SIPHONAPTERA OF NEW YORK

(Publication No. 9915)

John Maurice Geary, Ph. D.
Cornell University, 1954

This monograph of the Siphonaptera of New York State presents many unpublished records, and the synonymy of old published records is brought up to date. Several new records for the state are also given.

Forty-six species of twenty-eight genera are listed. These included two species, in two genera, which have not been recorded from New York, but which probably occur there. With these additions the list includes all known species which can reasonably be expected to occur in the north eastern part of the United States. Only nine species, of five genera, which have been reported from the eastern United States are not included in the list. The records of four species, reported from New York, are included as of doubtful occurrence. Three of these were apparently the results of erroneous determinations or labelling, and have long been doubted by siphonapterists. The fourth was reported in 1915 as a sub-species, based on a single female, and has not been recorded since.

The material presented is designed as an aid to new workers in the field. Very little material which may be found in texts on medical entomology is included, but illustrated descriptions and keys to genera and species are given. Indices to synonymy and hosts are presented, as are methods of collection of hosts and parasites, and instructions for the preservation and labelling of fleas.

192 pages. \$2.40. MicA54-3227

STUDIES ON THE CULTIVATION OF THE
AVIAN PLASMODIA WITH MODIFICATIONS
OF THE HARVARD TECHNIQUE

(Publication No. 10,072)

Stanley Glenn, Ph. D.
Syracuse University, 1954

Several series of studies have been undertaken to extend and amplify previous research on the *in vitro* cultivation of the avian plasmodia using the Harvard medium, with special emphasis on *Plasmodium hexamerium*. The Harvard medium served as the basic nutritive source, and modifications of the technique consisted of heterologous sera studies and the use of a series of growth factors as additives to the standard medium.

Two species were used in the present studies, *Plasmodium hexamerium* and *P. elongatum*; the former was selected as the index organism for the heterologous sera and growth factor studies, and the latter was used in standard culture studies. White Pekin ducklings were used to maintain the plasmodial strains and for viability tests.

The initial studies were a series of standard culture experiments of *P. hexamerium*, carried out on the basic Harvard medium, and the results confirm the findings of Manwell and Glenn (1953) regarding growth and reproduction *in vitro*. Maximal growth and reproduction were attained at 24 hours, and the parasitemia declined thereafter. Higher levels of growth were observed in the current studies than in the earlier work (e.g., 1.47 vs. 1.17 at 24 hours) and the length of the incubation period in viability tests was shortened from 6.4 to 3.9 days.

Similar experiments using *P. elongatum* were not very successful. Growth and reproductive indices were rather low, and the mean values did not achieve the 1.00 mark of survival. It is concluded that survival, rather than reproduction, occurred, since the viability tests were positive in 3 of the 4 experiments.

Substitution of normal pigeon plasma for the homologous duck plasma was not beneficial for the growth and reproduction of *P. hexamerium in vitro*. The mean values for the growth and reproductive indices of the standard control cultures were consistently higher than the experimental values. Nevertheless, some growth occurred in the experimental cultures during the first 48 hours of cultivation.

The turkey plasma studies gave better results: after an initial 24 hour lag period, growth and reproduction in the experimental cultures were higher than the control values. This work confirms the *in vivo* findings of Manwell (1952) regarding the use of the turkey as a host for *P. hexamerium* and indicates that the plasma plays an important role in this respect.

Three compounds were tested as additives to the basic Harvard medium: Vitamin B₁₂, folic acid, and a porcine liver coenzyme concentrate containing Coenzyme A, DPN, TPN, pyridoxal phosphate, and pyridoxamine phosphate. *Plasmodium hexamerium* was used as the assay organism.

The addition of Vitamin B₁₂ to the standard Harvard medium resulted in an initial lag period, after which the experimental values for growth and reproduction were higher than those of the controls. In addition, the host cells and parasites in the culture tubes containing vitamin B₁₂ exhibited a more normal staining and morphological picture than did their counterparts in control tubes.

The addition of folic acid showed the same effect of an initial 24-hour lag period, after which the experimentals manifested a steady increase in parasitemia, and were considerably higher than the controls with respect to growth and reproductive indices. The 72-hour values in several experimental cultures were the highest recorded in all of the *in vitro* studies on *P. hexamerium*; growth indices of 3.62 and 3.05 were obtained.

In the case of the coenzyme concentrate, the lag period was eliminated, and the experimental growth and reproductive indices were higher than the control values during the first 48 hours of cultivation.

When the above-mentioned growth factors were added to the Harvard medium in combination, the lag period was not evident, a steady increase in parasitemia was manifested, and quite respectable

72-hour indices for growth and reproduction were obtained. 159 pages. \$1.99. MicA54-3228

THE MOLECULAR BASIS OF THE SURFACE PRECIPITATION REACTION

(Publication No. 8550)

Paul R. Gross, Ph. D.
University of Pennsylvania, 1954

Supervisor: L. V. Heilbrunn

When a living cell, usually an egg cell or a protozoan, is crushed in its normal medium, the rapid outflow of cytoplasm from the points of injury is usually halted within a few seconds. This cessation of outflow (and prevention of disintegration of the cell) is accompanied by the formation of a precipitation membrane at the border of the extruded cytoplasm and by a general rise in viscosity of the injured cytoplasm. The entire complex of reactions involved in these processes is called the "surface precipitation reaction."

Excellent evidence exists which suggests that this reaction is the same as, or analogous to, the one which effects the sharp rise in the viscosity of normal protoplasm in the course of certain vital phenomena, such as cell division and response to stimulation. It is also known that the reaction is initiated by calcium ions, and that the surface precipitation reaction as well as cell-division, activation, etc., fail to occur in the absence of Ca^{++} .

This work represents an attempt to analyze the Ca^{++} -initiated reactions at the molecular level through the use of standard biochemical techniques applied to homogenates of eggs of the sea urchin *Arbacia punctulata*.

The addition of Ca^{++} to such homogenates of eggs previously freed of their ionic Ca results in a loss in the solubility of certain proteins of the homogenate. Experiments demonstrate that this effect is not to be attributed to an increased ionic strength of solutions of CaCl_2 , as compared to that in the KCl homogenization medium.

The precipitated material is rich in nucleic acid.

One of the results of the addition of Ca^{++} is the activation of a proteolytic enzyme, or enzymes, and the increased proteolytic activity results in the release of small quantities of non-protein nitrogen. Both the solubility loss and the proteolytic activation reactions are inhibited by ether and heparin. Experiments at alternate low and high temperatures suggest a causal relation between the proteolytic and the precipitation phases of the reaction.

Water extracts were made from homogenates with and without Ca^{++} . Electrophoretic analysis of these extracts suggests that the precipitating material comes from one of the several components represented, and that this component makes up a very large proportion of the total protein of the homogenate.

The precipitate formed in the presence of Ca^{++} has the fortunate property of adhering to collodion films, so that electron microscopy of the precipitate is possible. Electron microscopic observations reveal that the precipitating material consists of aggregates of discoidal or spheroidal particles of diameter $380 \pm 80 \text{ \AA}$. The precipitation appears to be the result of a kind of polyfunctional polymerization reaction.

The significance of these observations is discussed. 77 pages. \$1.00. MicA54-3229

STUDIES ON A NUCLEO-CYTOPLASMIC SYSTEM IN *PARAMECIUM AURELIA*, VARIETY 4: I. MUTATIONS OF THE GENE AND OF THE CYTOPLASMIC FACTOR. II. PHENOTYPIC VARIATION IN RELATION TO TYPE AND COMBINATION OF CYTOPLASMIC PARTICLES

(Publication No. 10,147)

Earl Dorchester Hanson, Ph. D.
Indiana University, 1954

Phenotypic variations in the "killer" trait in *Paramecium* can result from various types and combinations of the cytoplasmic factor kappa. The killer trait depends for its expression on kappa particles in the cytoplasm and gene K in the nucleus.

The physical basis of three spontaneous mutations, one of nuclear and two of cytoplasmic origin, affecting the killer character have been studied in *Paramecium aurelia*, variety 4. The nuclear mutation involves either the loss of chromosomal material including the K locus, or it is a gene mutation. If the latter, the simplest interpretation is that gene K mutated to k, an allele incapable of supporting kappa. The other two mutations proved to be mutations of kappa. One mutant kappa - slow hump kappa - is characterized by a decreased maximal reproductive rate. The other mutant kappa - pi - is characterized by loss of paramecin production, different shape and size, new serological specificity, resistance to high temperatures, and different mean concentration per animal under certain feeding conditions.

Apparently new types of kappa arise only by mutational changes since new types arising by recombination of genetic factors from two different "parental" kappas were looked for but not found. Pi and slow hump kappa, in the same animal, were used as the parental kappa. Selective techniques were employed which could have revealed even low frequencies of recombination had they occurred.

Utilizing different types of kappa, the interaction of two different cytoplasmic particles in a common cytoplasm has been studied. Under constant growth conditions, different kinds of kappa in the same animal attain characteristically different mean concentrations. (These mean values can be different from those found when each kind of kappa is present alone, i.e. in the absence of any other kind.) The result of this tendency of each type of kappa in an animal to

stable concentrations, is that a characteristic, constant ratio of the concentrations of the different kinds of particles exists for a given set of growth conditions. This ratio, however, changes with a change of growth conditions. Furthermore, the ratios differ for each combination of kappa types.

These findings can explain the establishment of normal and mutant kappa in the same animal and also the replacement of normal kappa by a mutant form. Further, they bear on the possible role of cytoplasmic elements in normal and abnormal development since different concentrations of different cytoplasmic substances can affect the potentialities of the cells containing them.

126 pages. \$1.58. MicA54-3230

THE PROFUNDAL BOTTOM FAUNA OF CAYUGA LAKE

(Publication No. 9794)

E. Bennette Henson, Ph. D.
Cornell University, 1954

This dissertation reports the results of a quantitative investigation of the macroscopic profundal benthos of Cayuga Lake, New York. Samples were taken from May through November in 1952 and from May through August in 1953, and seasonal changes of the component groups were observed. The data were collected from a single sampling area approximately 100 meters deep, located about ten miles from the southern end of Cayuga Lake.

On each collecting trip a series of five replicate samples were obtained from an anchorage within the sampling area. After all samples were counted, three samples of each series were used for dry and organic weight determinations, and the remaining two were preserved. Variances were computed for each sample series and for each group of animals of the fauna discussed; and analyses of variances were made for each to test the differences of means between days and years. Chi-square values were used to test the distribution of the fauna against the Poisson distribution.

A description of the lake and the Finger Lakes Region is given, including geologic history, meteorology, and inhabitation. Thermal, chemical, and biological characteristics of the lake are briefly reviewed.

An orange-peel dredge and a grit cone concentrating bag used in the investigation are described. Comparisons made between the orange-peel and Ekman dredges indicate that, with five samples, the two dredges sample the same average number of each component group of the fauna, and that, with the exception of the Ostracoda, the variances associated with the orange-peel were significantly lower than those taken with the Ekman. Therefore, the former is considered to sample more efficiently.

In 1952 the total population increased numerically from 3,000 in May to over 9,000 in November, aver-

aging 6,000 individuals per square meter. The *Oligochaeta* and *Pontoporeia* made up about 87 per cent of this average. The average dry weight was 878 milligrams, and the average organic weight was 688 milligrams. Between May 30 and August 14, 1952, the dry weight increased 140 per cent, which represented a net rate of increase of ten milligrams per square meter per day. In the same period the organic weight increased 83 per cent.

Several species of *Oligochaeta* averaged 3,600 individuals in 1952 and had an average dry weight of 268 milligrams per square meter.

Pontoporeia affinis var. *brevicornis* in Cayuga Lake is described. The population of *Pontoporeia affinis* (s. l.) was separated into young, juvenile, and adults. An increase in numbers of young individuals in the profundal region during the summer of 1952 has been attributed to a downward migration. The dry weight of all size groups was 366 milligrams per square meter. A life table has been constructed for this species.

Pisidium sp. averaged 370 and weighed 137 milligrams dry weight and 68 milligrams organic weight per square meter.

The Tenedepidae were represented by larvae of an undescribed species of *Metriocnemus*. Emergence occurred in October or November. The growth in weight in the individual larvae, in their last instar, approximated the exponential function. There was an average of 320 larvae per square meter in 1952.

The Ostracoda increased from 30 to 200 individuals per square meter in the summer of 1952 and a logistic curve has been constructed from the data.

All 1953 populations differed considerably from those of 1952.

A brief discussion of lake typology in reference to the profundal fauna is given. Cayuga Lake apparently occupies a position between *Orthocladus* and *Tanytarsus* type lakes. The dry weight of profundal benthos, approximately one gram per square meter in 1952, exceeds estimates from many other oligotrophic lakes.

140 pages. \$1.75. MicA54-3231

THE ANATOMY AND SKELETO-MOTOR MECHANISM OF THE HEAD AND PROTHORAX OF THE LARVA, PUPA AND ADULT OF *CORYDALUS CORNUTUS* LINN. (NEUROPTERA; MEGALOPTERA; CORYDALIDAE)

(Publication No. 9759)

Lewis Preston Kelsey, Ph. D.
Cornell University, 1954

The purpose of this study is to work out the relationships of the skeleto-motor mechanism to the external anatomy of all three stages, larva, pupa, and adult, of one of the more primitive forms of the Neuroptera, which may be used as a basis for general interpretations of the higher holometabolous insects; a review of the literature reveals a lack of work of this type.

Corydalus cornutus Linn. was chosen for this study as it is a primitive holometabolous insect which undergoes little change from larva to adult; is large; and is generally abundant. The members of the family Corydalidae are remarkably well suited to a study of this type as the head remains prognathous in all three stages and the prothorax shows only slight modification from the larva to the adult. This constancy of external features is further borne out by the constancy of the internal skeleto-motor mechanism of the head and prothorax of all three stages.

The principal controversial areas considered in this paper concern the frontal area of the head and the frontal sutures, the ecdysial line and its fate, the composition of the gulamentum and the so-called "gular sutures," the identity of the cervical region and the juglare plate, and the sternal areas of the prothorax. The study of the pupal stage and the study of the larval and pupal exuviae have thrown new light on the composition of the head sclerites. The musculature of the three stages is remarkably constant undergoing only minor changes; an annotated list of the muscles of the head and prothorax is included.

This is the first of a series of papers on the anatomy and skeleto-motor mechanism of the three stages of *Corydalus cornutus* Linn. Other papers are in progress in the Morphology Laboratory at Cornell University which will complete the anatomical studies of this insect.

121 pages. \$1.51. MicA54-3232

THE EFFECTS OF DEOXYPENTOSE NUCLEIC ACID AND OTHER NUCLEAR FRACTIONS ON *RANA* PIFIENS DEVELOPMENT

(Publication No. 7587)

Ruth Ann Hensley Neff, Ph. D.
University of Missouri, 1954

A material has been extracted from tissues of adult *Rana pipiens* which arrested development of the embryos of that animal during gastrulation or neurulation. The material was of nuclear origin, and has been prepared from sperm cells, and from isolated nuclei of erythrocytes, liver, kidney and spleen.

The material was demonstrated to be either identical to, or intimately associated with nuclear deoxy-pentose nucleic acid (DNA), since it could be isolated with DNA from whole tissue homogenates by a method which should eliminate or inactivate other materials. The activity did not depend upon a highly polymerized state of DNA; digestion with DNase did not destroy biological activity.

The blocking activity was also demonstrated in crude fractions of isolated nuclei. It has, so far, been found only in fractions rich in DNA, and particularly in that portion of the total DNA of nuclei which may be removed by digestion with DNase. The material responsible for blocking activity has not yet

been unequivocally identified as a distinct chemical species. The crude fractions of isolated nuclei which exhibited blocking activity contained large amounts of DNase digestion products, largely non diffusable oligonucleotides. These fractions also contained considerable amounts of nitrogenous material in excess of that present in the oligonucleotides. Evidence was presented that this material represented protein residues, nuclear PNA, or both. This nitrogenous material was not structurally associated with DNA nor required for the expression of blocking activity, since up to seventy per cent of the excess nitrogen could be removed without loss of activity. It was unlikely that protein was responsible for blocking activity since the activity was not diminished by progressive removal of protein, by trypsin digestion, nor by prolonged heat treatment.

The blocking activity of the material was destroyed by acid. No active preparation could be isolated from nuclei which had been exposed to acid prior to fractionation. Evidence was presented that the effect of acid could best be explained as an irreversible alteration of DNA or oligonucleotide.

It was concluded that the material responsible for arrest of embryonic development is a DNA oligonucleotide, or mixture of oligonucleotides, which may be complexed with protein, but which do not require protein for total expression of blocking activity.

Possible mechanisms of arrest were presented and discussed. It was postulated that the arrest was due to an interference, by introduced oligonucleotides, with the normal DNA metabolism of the embryos. This interference could be by means of a competitive inhibition of DNA synthesis, or by an incorporation of introduced oligonucleotides into cleavage nuclei, resulting in the formation of abnormal nuclei. It was concluded that arrest was not the result of the introduction of material which could be directly correlated with genetic material.

The biological activity reported was compared with other biological activities reported for DNA or nucleoproteins. The fact that no other DNA or oligonucleotide preparation from any animal other than *Rana pipiens* produced a similar arrest of *Rana pipiens* embryos suggested a degree of specificity for DNA or oligonucleotides, dependent upon the source of the preparation. It was suggested that the test system developed in the study provides a method for further study of DNA differences and specificity in a sexually reproducing organism.

301 pages. \$3.76. MicA54-3233

FURTHER STUDIES ON THE CHEMOTHERAPY
OF HEXAMERIUM AND ELONGATUM
MALARIAS IN THE DUCK

(Publication No. 10,089)

Ikedinachuku Okpala, Ph. D.
Syracuse University, 1954

The species of avian malaria used in this investigation were Plasmodium hexamerium and Plasmodium elongatum. The former belongs to a group of avian malaria parasites which are characteristically small in size with a moderate parasitemia; the latter belongs to larger species of bird malaria and is characterized by its ability to infect all blood and blood-forming cells, particularly the young red blood cells. While growth in other avian Plasmodia appears to be limited by the capacity of the invaded cell, in Plasmodium elongatum it is self-limited.

In the present studies the chemotherapeutic effects of chloroquine plus quinine, chloroquine plus primaquine, and of camoquin used alone against P. hexamerium in ducks, on the one hand, and of chloroquine, primaquine and camoquin used separately against P. elongatum, on the other, have been investigated. Dosages were relatively high: 0.02 mgm. per gram of body weight for quinine, 0.06 mgm. per gram for chloroquine, 0.004 mgm. per gram for primaquine and 0.0294 mgm. per gram for camoquin.

The efficacy of each drug or combination of drugs was measured in terms of its ability to suppress parasitemia and to achieve sterilization.

Results indicated that each combination of drugs (chloroquine plus quinine or chloroquine plus primaquine) showed a strong suppressive activity against hexamerium infection, and was able to clear blood of parasites completely during the period of drug treatment. Each drug combination was more suppressive than either of its components used alone. Camoquin used alone was also a good suppressant. While each combination of drugs was able to cure some cases of hexamerium malaria, none of its components could, when used alone, effect a cure. Camoquin possessed a greater curative potency than either of the two combinations of drugs.

Neither chloroquine, primaquine nor camoquin used against P. elongatum was able to completely clear blood of parasites in some of the treated cases during the drug therapy; the suppressive power of each drug against this type of malaria was rather mild; of the three drugs, primaquine was the most powerful suppressant but the least curative. In the ability to sterilize cases of Plasmodium elongatum malaria the drugs stood in the following descending order: chloroquine, camoquin and primaquine.

Since each of the drugs (chloroquine, primaquine) failed to sterilize a single case of acute stage of hexamerium malaria but was able to produce sterilization in some patent cases of elongatum infection, it seems probable that Plasmodium elongatum is more susceptible to these drugs than Plasmodium hexamerium.

In the therapy of blood-induced hexamerium and

elongatum malarias in the duck, neither chloroquine, quinine, primaquine nor camoquin was able to measure up to its reported performance against human malaria.

Primaquine, which has been reported to possess curative capacity against human malarias (vivax and falciparum) was curatively weak against hexamerium and elongatum infections in the duck; however, it exhibited schizonticidal as well as suppressive effect against the two species of avian malaria.

When the effect of the antimalarials used in these experiments against hexamerium and elongatum infections is compared with that of the same drugs against similarly induced and similarly treated human malaria, it seems evident that these two species of avian malaria (or at least the strain used of these species) are more resistant to these drugs than are the various species of human malaria. This becomes more convincingly so when the relatively high drug dosage employed in these experiments is considered.

193 pages. \$2.41. MicA54-3234

ORIGINS AND DISTRIBUTIONS OF
NORTH AMERICAN BIRDS

(Publication No. 9774)

Edgar Milton Reilly, Jr., Ph. D.
Cornell University, 1954

The North American bird fauna treated here is that listed in the Check-list of the American Ornithologists Union. The ranges of all species on this list were mapped and patterns of distribution noted.

Despite their powers of flight birds are limited by natural barriers as much as any other animal group. The following factors most affect the distribution of birds: (1) Physiographic barriers. (2) Climatic factors. (3) Physiological factors. (4) Mobility of the particular species. (5) Habits of the species. (6) Intra and inter-specific competition.

The earliest avian fossils are from the Upper Jurassic Era. These fossils are of birds in an advanced stage of evolution so the origins of the Class Aves must have been in an earlier Era. They probably arose from a group of Triassic reptiles known as Pseudosuchians. It is unlikely that avian flight arose along the proposed "Tetrapteryx" hypothesis. It is more likely that birds arose from pseudosuchians of arboreal habits with bipedal gaits with the tail used as a balancing organ. The flattening of the tail into a volplaning surface and the development of a fold of skin between the base of the tail and the forearm could lead more easily into avian structures and flight as they are known today.

Present distributions of major animal groups, particularly birds, may be most easily explained on the basis of our continental masses remaining in the same relative positions much as they are today. Where no direct fossil or geological evidence exists to support this view it is still more acceptable than an hypothesis based on present distributions of small

little known groups or fragmentary fossils of even less well known animals.

North America is more closely related to Eurasia, biologically and geologically, than it is to the West Indies or South America. Geological evidence supports only the Panamanian land connection presently extant and a broader connection between Siberia and Alaska. These two bridges have been broken and reconnected several times during the Tertiary Period and present bird distribution bears this out.

The greater area of North America lies in the temperate and polar regions; South America has most of its area in the tropical region. During separation of the continents North America was a reservoir of temperate forms and South America for tropical forms. While the Bering bridge was in operation North America received most new additions to its fauna and flora from Eurasia. Tropical species would not be as adaptable to temperate climates as temperate species would be to tropical climates thus birds from North America spread more rapidly into South America than the reverse.

Certain physiographic features of North America had great affect on avian distribution and subspeciation. These areas were given distinctive names and referred to as "Aviprovinces." Fifty-nine Aviprovinces were recognised.

The ranges of the individual species show dispersals and fluctuations leading to the following conclusions: (1) No range is static. (2) Physiographic barriers had definite effects on the subspeciation process. (3) The more sedentary species developed more subspecies. (4) The existence of "ecological" subspecies is related to formerly existing physiographic barriers. (5) Full speciation requires complete geographic separation.

329 pages. \$4.11. MicA54-3235

THE HUMIDITY REACTIONS OF GRASSHOPPERS

(Publication No. 9127)

Paul William Riegert, Ph. D.
University of Illinois, 1954

The humidity reactions of two species of grasshoppers, *Melanoplus bivittatus* (Say) and *Camnula pellucida* (Scudd.) have been investigated with the aid of an olfactometer designed by Willis, E. R. and L. M. Roth (Jour. Exp. Zool. 115:561. 1950). Grasshoppers were laboratory reared from field collected eggs. Food and water was supplied daily as described by R. W. Smith (Can. Ent. 84:269. 1952).

In the olfactometer the grasshoppers were given a choice between two alternative humidities that were presented in various combinations covering the relative humidity range. The desired humidities were obtained by passing air through sulphuric acid solutions of requisite density (see M. E. Solomon, Bull. Ent. Res. 42:543. 1951). The intensity of the humidity reaction was measured as an "Index of Reaction," this being an excess percentage of position records in the drier of two alternative humidities.

Normal, unstarved nymphs and adults of both species showed a distinct preference for the drier of two humidities. This 'dry' reaction was exhibited in all parts of the relative humidity range.

The intensity of the 'dry' reaction of *C. pellucida* increased markedly as the difference between alternative humidities was increased. *M. bivittatus* showed an almost uniform intensity of response when humidities differed greatly or by only 15% R.H. Nymphs and adults of both species were able to distinguish between humidities which differed by as little as 5% R.H. Intensities of reaction to equal differences of humidity appeared to be greater in the moist region of the relative humidity range.

During the moulting period nymphs of *C. pellucida* and *M. bivittatus* reversed their normal 'dry' humidity reaction and showed a marked preference for the moist environment. The 'wet' reaction was maintained for a few hours after moulting; usually until the cuticle had hardened and darkened and the insect had resumed feeding and normal activity.

Adult grasshoppers starved for 24 to 30 hours showed a definite reduction in the intensity of the 'dry' humidity reaction. A 'wet' preference was exhibited after three or four days of starvation and was maintained until death. A gradual decrease in the total body water resulted in an 8 to 11 per cent loss after five days of starvation. Total body fat decreased by about 40 per cent before death occurred. The greater portion of this loss took place after three or four days of fasting.

The humidity sensory receptor organs were located on the distal eight segments of the antennae. The removal of these segments resulted in a complete elimination of the humidity response. Extirpation of the labial and maxillary palpi produced no reduction in the intensity of the humidity reaction, hence, it is assumed that very few or no hygroreceptors are present on these appendages. Microscopic examination of whole-mounted antennae revealed a preponderance of sensillae on the distal six segments.

Grasshoppers, as observed in the olfactometer, reacted ortho- and klino-tactically to humidity. When placed in an aktograph (see Gunn, D. L. and J. S. Kennedy, Jour. Exp. Biol. 13:450. 1936) the records of activity showed that grasshoppers reacted in a positive hygro-kinetic manner (ortho-kinesis) because they were three or four times more active in moist air than in dry. In their avoidance of the higher humidities the insects also reacted klino-tactically.

99 pages. \$1.24. MicA54-3236

THE LIFE CYCLE AND EPIZOOTIOLOGY OF
THE RABBIT TREMATODE, *HASSTILESIA*
TRICOLOR (STILES AND HASSALL, 1894)
HALL, 1916. (TREMATODA: BRACHYLAEMIDAE)

(Publication No. 9775)

William Boyd Rowan, Ph. D.
Cornell University, 1954

The life cycle of the rabbit trematode, *Hasstilesia tricolor*, was traced in laboratory-raised specimens of the pupillid land snail, *Vertigo ventricosa* form *elator* Sterki, and domestic rabbits were infected with metacercariae recovered from experimentally infected snails.

The structure of the adult worm was examined and a number of additions were made to the original descriptions of Stiles and Hassall, and Hall. The relationships of the oviduct, the common vitelline duct, Laurer's canal, the ootype, and the uterus were clarified by studying serial sections of the fluke. The presence of a seminal receptacle and prostate glands is reported here for the first time. The structure and measurements of the adult worm were compared with a very similar species, *Hasstilesia texensis* Chandler, 1929. It is concluded that the validity of the latter species depends on detailed studies of the structure and biology of both *H. tricolor* and *H. texensis*. Morphological differences attributable to the influence of different hosts on the worms or to the age of the worms should constitute an important part of these studies.

The egg of *H. tricolor* is small and elliptical, bears a serrate-edged operculum and an anopercular filament. The partially ciliated, pear-shaped miracidium emerges from the egg after the egg is ingested by the snail host. The miracidium penetrates the intestine of the snail, establishes itself in or about the digestive gland, and develops into a sporocyst. Mature sporocysts are thin-walled structures bearing seven to nine simple branches, the branches radiating from a central core. The sporocysts give rise to spinous, short-tailed cercariae, and these lose their tails to become metacercariae. Development in the snail requires 12 weeks. Fully formed metacercariae lie unencysted within the sporocysts, and develop to mature flukes in three weeks when fed to domestic rabbits.

Snails infected with metacercariae can be found throughout the year but are most abundant in fall and winter. Snails bearing infective metacercariae are frequently encountered several inches from the ground on vegetation during freezing weather. Domestic rabbits, caged on infective ground, acquire infections throughout the year, presumably by ingesting infected snails. The incidence of immature flukes in cottontail rabbits is higher in fall and winter than in spring and summer. The average number of mature flukes in adult rabbits increases from summer to spring.

The tolerance of the egg of the fluke to various temperature and moisture conditions as determined by laboratory experiments exceeds the variations in these conditions observed in the field. Periods of

low soil moisture, capable of delaying development of the eggs, occurred for only a few days in mid-summer, and the temperatures measured in the field were neither sufficiently high nor low to injure the eggs. This exceptional tolerance of the egg to environmental conditions, and the abundance and availability of the snail at all seasons permits the cycle to continue throughout the year at northern latitudes.

86 pages. \$1.08. MicA54-3237

THE FATE OF DENERVATED TASTE BUDS
IN NORMAL AND REGENERATING
BARBELS OF THE CATFISH

(Publication No. 10,160)

Charles Eugene Wagner, Ph. D.
Indiana University, 1954

The fate of taste buds after denervation of normal barbels and after delayed denervation of regenerating barbels was studied in the catfish, *Ameiurus melas* (Jordan and Cope).

Normal barbels were denervated by cutting and removing a small segment of the nerve trunk as it entered the base. Additional denervation operations were carried out at suitable intervals to prevent re-innervation. Unoperated barbels were kept as controls. Tips of barbels were removed every two or three days after the initial denervation operation, fixed in Bouin's fluid, and divided into proximal and distal segments. The proximal segments were prepared according to the method of Romanes (1946) to confirm the denervation operations. The distal segments were stained with alum cochineal and Mallory's solution II and used for studying taste buds.

Taste bud cells in normal barbels undergo marked changes in size and shape after interruption of their nerve supply. The changes are characterized by a great reduction in the amount of cytoplasm of the sensory cells. Since the changes are reversible upon reinnervation of the sensory cells, the phenomenon should be called modulation rather than dedifferentiation.

Modulation takes place more rapidly at higher temperatures than at lower temperatures. Taste bud cells in advanced stages of modulation are similar to surrounding epidermal cells, but are crowded together at the tip of a dermal papilla and take a darker nuclear stain. Modulated taste cells remain alive for as long as 51 days (at 16°C) in a nerveless condition. Whether these cells can exist for longer periods in the absence of nerves has not been determined.

Amputated tips of barbels regenerate and become equipped with taste buds if the nerve supply of the stump is not disturbed.

Tips of barbels were amputated, leaving short stumps. The operated fish were next divided into six groups. On the 6th, 9th, 10th, 12th, 13th, 14th and 16th days after amputation half of the barbel stumps of each fish in a group were denervated at their base; the remaining stumps served as controls.

Once a stump had been denervated it was reoperated at 8-day intervals to maintain denervation. Measurements of both denervated and control barbels were made at 3-day intervals. The tips of experimental and control barbels were removed on the 30th day following amputation and examined histologically according to the methods outlined previously.

Barbels denervated before the 13th day following amputation (25°-26°C) show wound healing but no further increase in length and no taste buds in the healed tip. Barbels denervated on or after the 13th day show regeneration similar to that of the control barbels. Regenerated tips of the experimental barbels contain well-differentiated taste buds.

91 pages. \$1.14. MicA54-3238

THE DISTRIBUTION AND ECOLOGY OF THE
AMPHIBIANS, REPTILES, AND MAMMALS OF
THE THOUSAND ISLANDS REGION, NEW YORK

(Publication No. 9930)

William Ernest Werner, Jr., Ph. D.
Cornell University, 1954

The purpose of the study was to determine the distribution of the amphibians, reptiles, and mammals in the Thousand Islands Region, and to investigate the effects of isolation and limited area of the islands on these vertebrates.

The area studied included ten islands of the St. Lawrence River, and twelve miles of the shoreline opposite them, in the vicinity of Alexandria Bay, Jefferson County, New York. One of the islands chosen for study was over 7000 acres in area, while the other nine ranged from one to 18 acres. Lengths of shoreline, distances from the mainland, and areas are given for each island. Lists of dominant plants, the vertebrates collected, and description of habitats are given for each area studied.

Measurements, descriptions, and data secured on reproduction, habits, abundance, habitat, parasites,

and food are presented for each species. The distribution of each species found is discussed, including the factors most important in its distribution, where indicated.

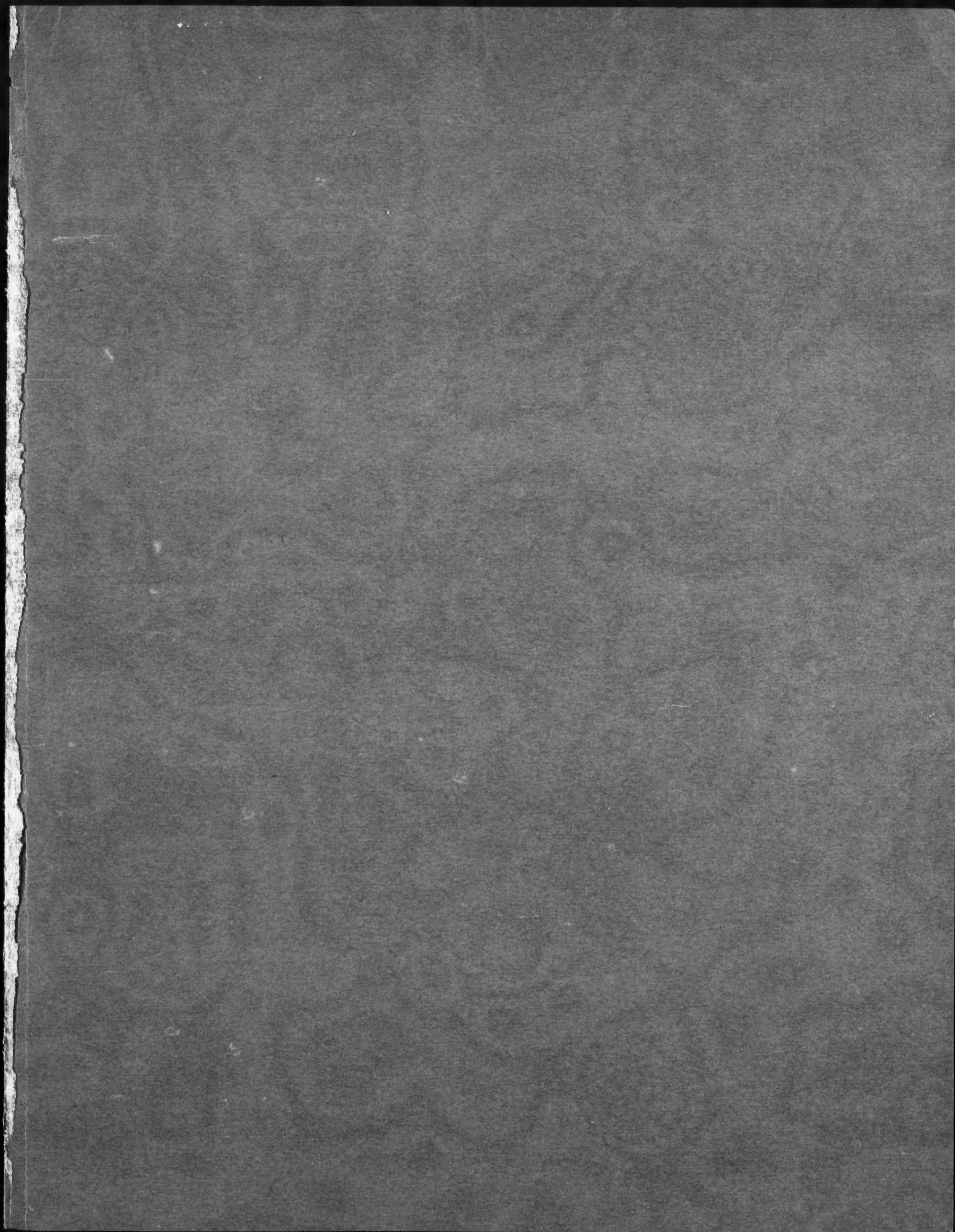
Twenty-three species of mammals, 15 species of amphibians, and 13 species of reptiles were collected. Records were obtained for Hemidactylum scutatum, Sternotherus odoratus, Emys blandingi, Terrapene carolina, and Elaphe o. obsoleta, all of which are at the periphery of their probable northerly distribution in this area. Records of Sylvilagus floridanus mearnsi were established.

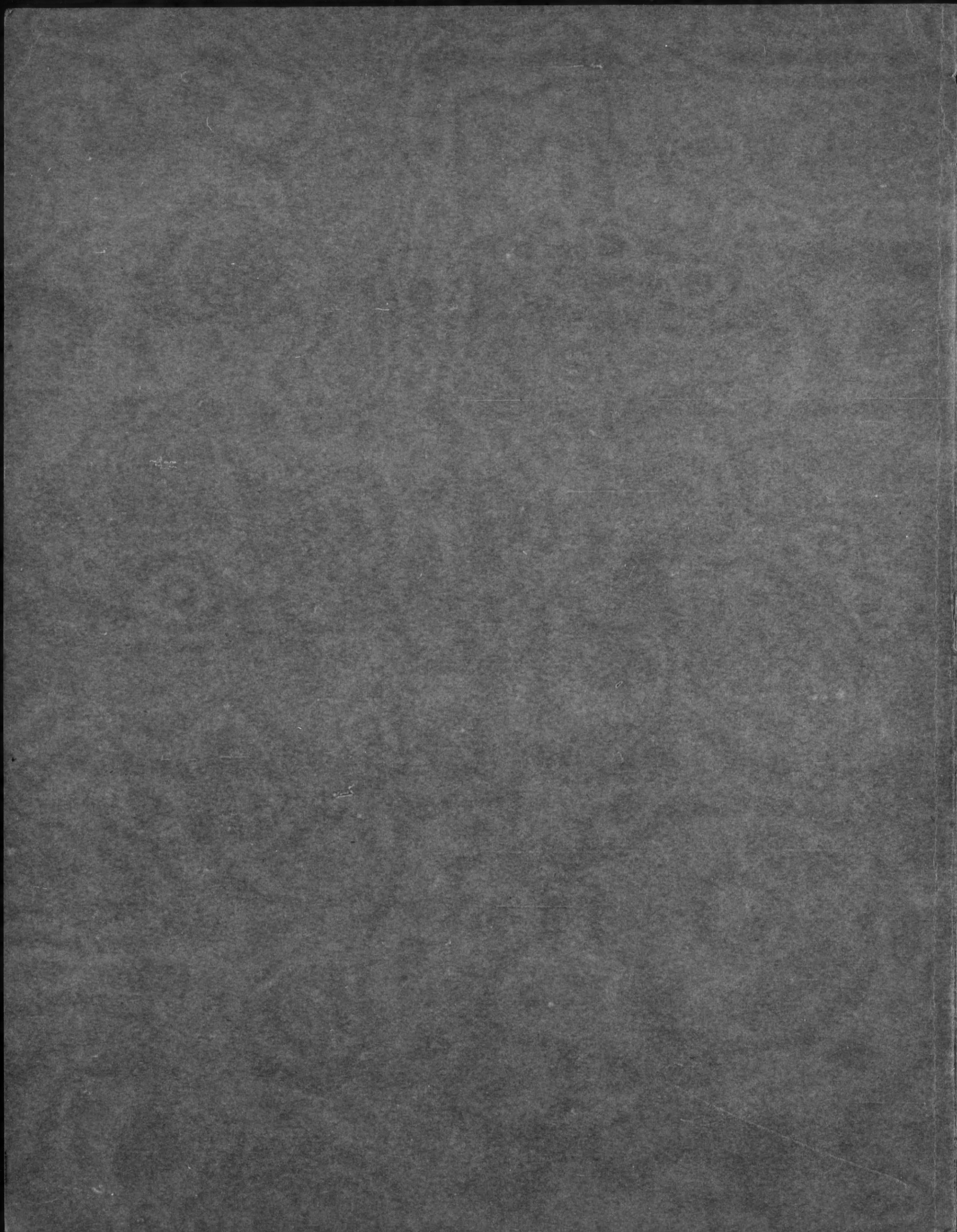
It appears from the evidence gathered that nearly all of the amphibians, reptiles, and mammals of the area can gain access to any of the islands in this region of the river. Size of the island, suitable habitat, breeding sites, and distance of the island from the mainland appeared to be the major factors determining the presence of species on the islands. Microtus p. pennsylvanicus was the only one of the vertebrates studied that was present on all the islands. On three islands it was found in wooded areas. Tamias striatus lysteri and Peromyscus leucopus noveboracensis were not found on any of the small islands except one that had recently been part of the mainland. Blarina b. brevicauda was found on all but the smallest and most isolated islands.

Natrix s. sipedon was the most widely distributed reptile, being found on eight of the islands, while the garter snake, Thamnophis s. sirtalis was found on five of them. Rana p. pipiens was collected on six islands, Rana clamitans on five, Plethodon c. cinereus on two, and Ambystoma maculatum on one. Opheodrys v. vernalis, Thamnophis s. sirtalis, Natrix s. sipedon, Terrapene c. carolina, Ambystoma maculatum, and Microtus p. pennsylvanicus were found on one of the most isolated islands, Ironsides Island.

No case of speciation was found on any of the islands studied. A few aberrant forms of Microtus p. pennsylvanicus and Blarina b. brevicauda were collected, all on the smaller islands.

162 pages. \$2.03. MicA54-3239





DISSERTATION ABSTRACTS

Volume XIV, No. 12

1954